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Author	Fiamenghi, Geraldo Antonio
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INTERACTION BETWEEN INFANTS:
UNDERSTANDING INTERSUBJECTIVITY
AND
EMOTIONAL EXPRESSION

by

Geraldo Antônio Fiamenghi Jr

Doctor of Philosophy
University of Edinburgh

1997



DECLARATION

I hereby declare that this thesis was composed by myself and that the work within is my own.

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DEDICATION

To Cristina, who changed her life completely to follow my dream, keeping her confidence and enthusiasm, despite my moaning and complaints,

To Mateus, my wee Scottish pride and joy, who is teaching me much more than any postgraduate course or Psychology book could,

You are the only reasons for this.

Com todo o meu amor,



"...Let the children come to me, and do not hinder them; for to such belongs the kingdom of God. Truly, I say to you, whoever does not receive the kingdom of God like a child shall not enter it."

(Luke, 18: 16-17)

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ABSTRACT

Infants are born able to express their emotions, and they can synchronise their expressions with their mothers' acts. They are coherent psychological beings, well equipped for social life and sensitive to supportive expressions of adults. Psychologists differ in their interpretation of the infant's independent initiative in these interactions. Although the theoretical importance of research on infant-to-infant emotional expression and communication is obvious, there are few studies investigating how infants under 10 months communicate with peers and the emotions that are expressed.

In an attempt to answer questions about young infants' emotional development and communicative emotional expression, I have studied the interaction of pairs of infants between 20 and 42 weeks of age. I also investigated the sensitiveness of paired infants to the motives and feelings of their partners. I measured turn-taking, imitation, and both local and general bodily emotional expressions of a reciprocal or complementary form.

A Cross-Sectional study recorded pairs of infants at 20-25 weeks (6 months), 31-35 weeks (8 months), 36-40 weeks (9 months). Nine subjects from middle class families, 3 girls and 6 boys were videotaped in same age dyads, seated on their push-chairs, facing each other. There were 3 dyads at each age, 2 girl+boy, 1 boy+boy. In addition, 2 boys and 2 girls were recorded at 6, 8 and 9 months), to obtain Longitudinal data. At each age there was a pair of boys, a pair of girls, and 4 girl+boy pairs. Finally, in a study of interactions with a self-image, 9 subjects (4 at 6 months, 3 at 8 months, and 2 at 9 months) were videotaped facing their reflection in a mirror box containing a concealed video camera. Micro-analysis of the first 2 minutes of interaction produced a detailed description of the infant's behaviours. Four levels of coding were created by grouping microanalytic categories: to define, first, Behavioural activities; then a Functional level; and finally, Negotiatory and Emotional acts.

Results show that 6 month-olds try to make contact, but they do not sustain interaction. As a result, invitations for interactions occur frequently, but they are not always followed by appropriate responses. The infants are very interested and very friendly to one another, but as a result of

their inability to keep attention, they often show indifference. At 8 months, infants show less indifference. They keep their interactions going for longer periods, and show much more interest in the other infant, with no irritation. At 9 months, another change is evident. Interactions and invitations are more balanced, meaning that the older infants are trying to give the partner turns in interactive strategies. At all ages, girls were more interactive, showing more emotional expressions than boys. Imitation is present in all ages, and at a very significant rate. It seems that infants use imitations to assist and regulate interaction: to start it, to keep it going, and even to restore it, when it fails. In the Mirror study, boys were more interactive than girls, with more positive emotional expressions. This result is opposite to the differences between boys and girls observed in the Cross-Sectional and Longitudinal studies, where girls were more responsive. At all ages, infants are very attentive to their mirror images, which attract them and excite a richer variety of expressions than they display when faced with another infant. An important finding is that the 6-month-olds showed clear evidence of self-recognition in their emotional expressions and interactions.

These findings have important implications, and many are new. However, they are given cautious interpretation, as this is an exploratory study, with very few subjects.

Chapter I

INTRODUCTION AND PURPOSES OF THIS THESIS

This thesis was planned as a study of interactions between infants, and of the emotions that pervade these interactions. I expected to shed some light on intersubjective processes that occur in early development and to examine the hypothesis that such processes are innate substrates of human beings. For these purposes, this thesis was organised in six chapters.

The first chapter gives an account of some of the principal psychological theories of emotion. A theoretical discussion about the concept of 'intersubjectivity' follows, as the Theory of Innate Intersubjectivity is the foundation of this thesis. Literature reviews on infant-infant interactions, gender differences and mirror interactions are also presented in this chapter. It concludes with a summary of the main purposes of this thesis.

The second chapter explains the methods of data collection and analysis. Infants whose mothers were able to come to the University were recruited and were paired according to their ages. The infants were recorded in same age pairs, seated in their push-chairs, facing each other, at 6, 8 and 9 months. The recordings were made with two professional video-cameras, attached to a mixer, producing a split-screen image. In addition, the infants were individually recorded facing a mirror-box. Three studies were elaborated: a Cross-Sectional study, a Longitudinal study and a Mirror study. The analysis for all three studies sampled 3 minutes of interaction of each dyad at 6, 8 and 9 months.

The third chapter explains the different systems used to code the data which I expected to obtain from the analysis of video tapes. In the first place, I reviewed coding systems used by other authors, in order to decide the one that would be appropriate for the data collected. At the end, four coding systems were devised, each one being derived from the more detailed systems. It was necessary to start with a microanalytical coding of all the behaviours of possible interest. Without this, it would not have been possible to understand the structure and function of the behaviours. The final two functional coding systems were designed to measure Intersubjective Functions and Emotions, respectively.

The fourth chapter, the largest one in the thesis, presents the results for the Cross-Sectional, Longitudinal and Mirror studies, with the statistical analysis, tables and graphs summarising the principal findings.

The fifth chapter discusses interpretations of the results found. It is in four parts, as follows: infant-infant interactions; emotional interactions; gender differences and mirror interactions.

Finally, the sixth chapter draws the main conclusions of the thesis and discusses possible uses and future directions of research into infants communicative awareness and the emotional regulations of interactions between peers in the first year.

1. HISTORICAL VIEWS AND DIFFERENT THEORIES OF EMOTION

Emotions are physiological and psychological reactions, with influence on perception, learning and performance.

The concept of emotion in Psychology is confused because there is no agreement on a definition. Some researchers separate emotion from motivation, others believe that emotions are only a category of motives; some define emotion subjectively, based on the feelings people experience, others see emotion as physiological changes of the body. Most psychologists emphasise reactions to stimuli as the main component of emotion; others concentrate on the perception of the situation that causes emotion or on the effects of emotion on behaviour.

The problem of the relationship between consciously experienced emotions and physiological changes was relatively simple in philosophical thought until the 19th century: it was accepted that we consciously feel an emotion and the physiological changes are a result of that experience.

Wundt (1874), the creator of scientific Psychology, described emotional phenomena as a separated group of psychological processes that seem very distinctive. He considered emotion as different patterns of sensations. We could then say that they are unlimited in number, because Wundt described many different sensations. He divided emotions in six groups, according to three different dimensions:

'pleasure - unpleasure'

'excitement - calm'

'tension - relief'

Wundt's system received much criticism, because of the large number of emotions considered by him.

Titchener (1896) did not agree with Wundt and considered only two kinds of emotions: 'pleasure' and 'unpleasure'. He said that Wundt had

confused emotion with emotional states. He then defined an emotional state as a link between a sensation and one of the basic emotions of pleasure and displeasure. The two kinds of emotion follow different sensations and create with them the emotional states, that some persons confuse with the emotions.

William James (1890) was the first to seriously defy the traditional view, which perceived the physiological changes as the results of emotional experience. In 1884, James wrote that the conscious experience of an emotion follows the body's reactions; reactions which are approximately automatic responses to environmental stimulation. The most important part of physiological reaction is placed by James in the internal organs; the heart, stomach, intestines, lungs, blood vessels, and so on. James understood that learning played an important role on determining which stimuli would elicit the physiological reactions. However, he insisted that the sensation of fear does not come from the perception of a *stimulus*, for example, something dangerous, but from the physical reactions of held breath, racing heart, staring eyes, that follow this perception. Carl Lange, the Danish scientist, formulated a similar theory, almost at the same time, and thus the theory of the primacy of physiological and bodily reactions is known as the James-Lange theory, the essential novelty of which may be summarised by the following examples:

Classical view: I see a bear; I'm afraid; my body prepares to escape.

James-Lange theory: I see a bear; my body prepares to escape; I'm afraid.

The school of Introspective Psychology, represented by the psychologists above, made important observations concerning the emotions, for example:

The adaptation of the emotions to emotional stimuli: long lasting stimuli causing pleasure or unpleasure tend to be accompanied by a decrease in the sense of pleasure or unpleasure. There is however, no adaptation to pain.

The concept of emotional diffusion: emotions that follow particular sensations may be transferred to them, that is, those sensations gain the ability to arouse the emotions.

Introspective Psychology identifies emotions with the physiological changes, regarding them as the source of the emotions, as in the James-Lange theory, but on the psychological level emotions continue to be considered as consciousness acts, which may be analysed through application of the introspective method.

Freud (1901), conceiving man as an active being, gives emotions a prominent role in his Psychoanalytic theory. Emotions are the fundamental regulators of human actions and they are described as psychological process with specific functions. Psychoanalytic theory identifies the source of emotions with instinctive biological impulses, organised as the 'id'. As the individual's relationship with the physical and social environment develops, emotions relate to objects, giving each a specific value. In these relations with the environment the control mechanisms that mould emotional reactions are formed. A late result of experienced relations with the environment is the creation of new psychological structures that represent the social aspect in human life, 'super-ego'. In some situations, the individual 'ego' eliminates some emotions from consciousness. The process of elimination from the consciousness of socially

undesirable emotions happens as a consequence of fear. As a result, the relation of some emotional processes with the rest of the personality can be disturbed, leading to psychological unbalance. The functioning of those structures (id, ego and super-ego) is believed to be the source of a rich variety of acquired emotions (shame, pride, etc.).

Psychoanalysis, thus conceives emotions as follows:

1) The fundamental source of emotions is in the biological functions of the human organism. During the bio-psychological development, new psychological structures are formed and they become a new source of emotions.

2) The function of emotions is to be the regulators of human activities. The present organisation of emotional drives decides on the activity: some irregularities of emotional processes are sources of psychological unbalance.

3) During the first part of human development, the infant is completely dependant on the *id*'s emotional drives and instincts, the work of which is based on the pleasure or unpleasure rule. New regulations in emotions evolve as *ego*-based intellectual processes develop (perception, memory, reasoning). Intellectual processes work as regulators of emotions as the subject begins to follow the 'reality principle'. And, in the third level of personality development, the *super-ego*, there appear processes that eliminate socially undesirable emotions.

Psychoanalytic theory is the expression of a 19th century view of the world (the beginning of a scientific materialistic approach to everything). Consequently, it sees a need to put emotions under the control of the intellect, because the organic emotions seem to have a negative potential, leading to mental disorders. Infants without knowledge from experience, are not able to

cope with their naked emotions. They must acquire a paraphernalia of psychic processes and defences and intellectual interpretations.

Behaviourism is founded in physiological analysis of psychological problems. Watson (1931) defined emotions as a specific group of reactions that appear under three types: fear, rage and happiness. Each one of these can be described by objective methods of research, that is, through the observation of the organism's behaviour. Watson specifically identified emotions as vegetative and glandular reactions, giving them an innate quality. He observed emotions as special patterns of responses that are initially evoked by unconditioned stimuli. He noticed that those patterns could be linked to initially neutral stimuli, through Pavlovian's conditioning technique (for example, the study of little Albert and the white rat, in Watson & Rayner, 1920). Studying new-born babies, Watson concluded that there were only three kinds of patterns, called X, Y, and Z. These earliest patterns are the prototypes of rage, fear and happiness. According to Watson, all the other emotions are based on those three, as mixtures or combinations that are constructed through operation of complex Pavlovian conditioning methods.

Cannon, an English physiologist began, in 1927, an investigation of these phenomena, and his results are opposed to James-Lange's and Watson's theories. He discovered that experimental animals and patients who had the neural connections between viscerae and the brain sectioned still showed rage, fear, and other emotional reactions. Another experiment consisted in producing visceral changes associated to emotion independently of the external stimuli by pharmacological intervention and verifying if the subject still experienced an

emotion. For instance, injecting adrenaline, increases heart rate and produces other organic reactions. According to James-Lange theory, the subjects should experience emotions appropriate to these physiological changes. However, the subjects did not feel a true emotion; they report only a feeling "as if" they were afraid of something, or "as if" they were anticipating a happy event. On the other hand, drugs acting upon the viscerae do affect the subject's reaction to external stimuli. These studies showed that visceral reactions are important in determining the individual's tendency to react to an emotional stimulus, but that they are not enough to generate the whole emotion.

Cannon, then, proposed an alternative theory to explain emotions. It is called the thalamic theory, and as it was suggested by Bard as well, it is known as the Canon-Bard theory. According to this theory, the origin of the emotions is in processes that arise from sensory impulses that come to the thalamus, at the bottom of the encephalon and dorsal to the hypothalamus. On the way via the hypothalamus, arriving messages become "emotionally loaded". Normally, the cortex will inhibit this emotional reaction at the thalamus, but if it does not do that, emotion is discharged. This discharge consists of a simultaneous emotional flux from the thalamus to the cortex, upwards (forming the conscious emotional experience) and, from the thalamus to the body, downwards (producing the visceral and muscular expressions). We find in this theory the first clear identification of emotion with neurophysiological processes in the central nervous system. It approaches the current idea about emotion and the importance of cerebral mechanisms. However, a very extensive array of brain structures are now identified as the substrate of emotions, as discussed below.

Although James-Lange and Cannon-Bard theories recognise the importance of the interpretation of situations and the feedback of autonomic system in emotional experience, they do not study how interpretation occurs. Modern research on this topic was extended in Schachter and Singer's views on emotion. They agree with James that the feeling of emotions is elicited by the perception of the feedback of body responses, but they also believe with Cannon, that this feedback is not sufficiently differentiated to generate many subtle emotional distinctions. There are, for example, approximately 558 different names to designate emotions in the English language. To reconcile these two different approaches to awareness of emotion, Schachter has proposed that emotions are produced either by the feedback of peripheral responses or by a cognitive evaluation of the situation that caused these responses (Schachter and Singer, 1962). This way, cognitive interpretation happens twice: once when we perceive the situation that leads to body responses and again when we identify the feedback of those responses as a specific emotion. The following scheme explains Schachter-Singer's theory:

1. Sensation (stimulus: BEAR)
2. Perception ("It's a bear!")
3. Body responses (Brain to the body: increase of heart rate; running)
4. Perception of body responses ("My heart is accelerated; I am running")
5. Emotional experience: interpretation of body responses ("My heart is accelerated because I am afraid of the bear").

As in the James-Lange theory, the first step is the perception of a situation, followed by body responses. However, while James said that the

brain perceives the responses as a particular emotion only based on the feedback, Schachter argued that the brain can interpret a specific pattern of feedback in different ways and give it many labels. According to Schachter and Singer, the cognitive act of giving a name to a previously undifferentiated pattern of physiological awareness constitutes the core of emotion. Naming depends on an attribution, that is the process of identifying the cause of an event. People can attribute their state of physiological awareness to different emotions, depending on the available information about the situation. For instance, if someone is watching the final minutes of a football match, he will attribute the high heart rate, respiratory rate and sweating to the excitement; but he can attribute the same physiological reactions to anxiety, if he is waiting for the beginning of an important exam. Therefore, the emotion felt when seeing a bear in the forest may be fear, excitement, fright or surprise, depending on how the perceiver labels his/her reaction.

Tomkins's affect theory (Tomkins, 1962) distinguishes four kinds of emotional organisation or individual "affect theories":

1. A monopolistic type, in which a single emotion tends to dominate the affective life of the individual (as, e.g., in the distress or anger-prone individual),
2. An intrusion type, in which a minor element in the general structure of personality intrudes and displaces a dominant affect under specific conditions,
3. A competition type, in which one emotion-based structural aspect of personality perpetually competes with others in the interpretation of information,

4. An integration type, in which no single affect theory is permitted to dominate the personality in a monopolistic way.

The most developmentally favourable outcome (the integration type or affectively balanced personality) results when affect socialisation is "rewarding" rather than "punishing". Affect socialisation is rewarding when social agents permit or encourage the child to maintain positive affective states and help him or her to reduce or attenuate negative affect states when they occur. The attenuation of negative affect states is achieved when the caregiver shows a little of a particular negative emotion towards the child or others, helps the child attenuate negative affect when it occurs (by de-emphasising, rather than amplifying the experience), communicates tolerance of the negative affect within the self and in the child, shows affective engagement with the child or adult having negative affect (both verbally and nonverbally, nonverbal engagement being especially important), shows consistency among ideological posture, action, and affect with respect to the emotion, and helps the child cope with the sources of negative affects so as to avoid their unnecessary provocation. Tomkins suggests that parents should teach tolerance rather than avoidance of negative affect experience.

Arnold (1968) has proposed a functional relation between the emotional experience and the bodily expression. She observes that little emphasis has been given to the initial perception. In her viewpoint, not all perceptions will result in an emotional reaction, and thus there is a separate mechanism which evaluates the situation. So, Arnold defines emotion in a motivational sense.

She suggests the following:

1. Perception: A neutral reception of external stimuli.

2. Evaluation: An appreciation of the stimuli as good or bad.
3. Emotion: A tendency towards stimuli judged as good and opposed to those judged as bad.
4. Expression: A pattern of physiological changes organised towards approach or withdrawal, different in each emotion, and that accompanies the tendency felt.
5. Action: The approach or withdrawal may occur if another emotion does not interfere.

The tendency to approach or to withdrawal is a basic component of the directional aspect of a motive, while the visceral changes are considered preparation for the body to execute the behaviour.

This admission of the importance of internally generated motive states for emotion changes the interpretation in an important way away from preoccupation with stimuli for emotion from outside the subject.

Darwin (1872) was a naturalist before a psychologist. His analysis of emotional expressions leads to a concern with communication and thus to interest in the motive sources of emotion. The descriptive ethological account of emotions situates them in communication between subjects and their motive states.

Izard (1971) created a Differential Emotions Theory, focusing on a limited number of discrete, differentiated, fundamental emotions, which have individual signal properties (i.e., different facial, vocal and gestural attributes) and provide important communicative links between individuals. Facial and vocal expressions of emotion are fundamental in the infant's ability to communicate needs and establish affective relations with the caregiver in early development. Emotions develop as a consequence of maturation of the nervous

system, of changing adaptational needs, and of cognitive development. As emotions are neurophysiological based behaviours, much early affective behaviour is innate and stereotyped, although socialisation quickly influences its subsequent development.

MacLean's studies (1952) led him to consider what he defined as the limbic system, a phylogenetically very ancient group of cortical structures, forming with sub-cortical mechanisms an integrated neural system, responsible for emotional process. Although Brodal's evaluations of MacLean's studies have questioned what brain areas would be considered "limbic" ones (Brodal, 1982) and have demonstrated that some limbic areas, such as the hippocampus, have more linkages to supposedly cognitive processes than to those identified as emotional ones, the limbic system hypothesis is still very influential and remains a dominant view of how the brain mediates emotion. Current anatomical studies of the emotional motor system (Holstege et al, 1996) indicate a very large number of structures in all levels of the brain stem, in the hypothalamus, basal ganglia and amygdala, and in the limbic cortex.

Recently, LeDoux (1989) has suggested that the amygdala is a focal point in the affective system. He argues that relationships among amygdala and cognitive areas (such as the hippocampus and the neocortex) allow interactions between emotions and cognition, though emotions and cognition are, he proposes, processed by different neural systems. Another important observation is that memory plays a fundamental role in the awareness of the emotional processes. This awareness occurs when "event, affect and self-representations simultaneously coincide in working memory" (p. 284). However, LeDoux calls our attention to the fact that there are still many gaps to

be filled in the relationship between psychology and neurobiology of emotion, but his aim is to show that the two fields are much closer than was thought before.

This same point is made by the neuropsychologist Damasio (1995), who shows that brain lesions that change emotions and temperament also transform cognition.

This review shows how many and how varied are the explanations for emotion and how, in the final analysis, each one of the theories proves insufficient, although many seemed to be plausible when they were first formulated.

As a result, we could say that Psychology will probably never find just one answer to its question regarding the value of emotion. Maybe because the subject is human behaviour and its peculiarities, we will never be able to form more than a partial general theory, subject to change over time. Thus, the first commandment in the study of Psychology must be: here is not *the* truth, but *a* truth.

2. INTERSUBJECTIVITY AND THE DEVELOPMENT OF EMOTIONS

Psychology has always been concerned with the study of development, as a means to help in the creation of new therapeutic procedures, and new educational strategies, and to understand the original motives behind how people interact, react to their environment, think and speak, love and hate, live and die.

For a long time, Psychology accepted, as did the parent discipline Philosophy in the period of the Enlightenment, that the new-born infant would have a very limited repertoire of emotional responses. Many scholars believed that at birth there was only a kind of excitement. Beyond this emotion, there would be only passivity, which is probably not to be regarded as an emotion. The infant's excitement was marked by crying, twisting of the body, disturbance. The quiet and resting state was emotionally neutral. Thus, at first, the only emotional state would be a relatively unpleasant excitation from passivity.

In the first three months, according to this classical view, behaviour would reflect the infant's internal state, being the direct responses to environmental and internal stimuli direct; only gradually recognised cognitively with an adequate category or label. This way, typical emotional patterns, as well as their expressive behaviours are differentiated and developed through maturation and experience. It follows that emotional exchanges with other persons could only be possible after this maturation had occurred. The constructivist epigenetic approach in Psychology, which assumes minimal psychological organisation at birth, makes it difficult to understand the apparent delicacy and appropriateness of infants' reactions to how persons

behave with them, and their ability to recognise an individual who offers care and love. It leads to difficulties when we consider how positive interactive exchanges between infants and other persons are maintained and regulated.

In Piaget's (1952, 1954, 1962)) theory of infants' developmental egocentrism, infants under one year were considered incapable of communicating with others of the same age. For many years, Piaget's ideas were prevalent and unchallenged in child developmental research.

Recently, however, these views have been questioned and some researchers have seen the infant's relationship with others as a manifestation of what is called intersubjectivity - an innate psychological capacity for recognising and communicating with psychological states of other individuals. The idea of human subjects being necessarily in relation and mutually influenced is, in fact, not new outside psychology. Actually, the concept of human intersubjectivity has long been the central interest in Philosophy, and in Religion.

For example, such a way of thinking was clearly articulated in Existentialism. Sartre (1970) considered that one's existence could only be 'justified' by the state of existence of the other. Without him or her, I would not exist:

Pour obtenir une vérité quelconque sur moi, il faut que je passe par l'autre. L'autre est indispensable à mon existence. Ainsi, découvrons-nous tout de suite un monde que nous appellerons l'intersubjectivité, et c'est dans ce monde que l'homme décide ce qu'il est et ce que sont les autres.

(Sartre, 1970, p. 67)¹

¹"In order to grasp some truth about myself, it is imperative that I pass by way of the other. The other is vital to my existence. Therewith, we quickly discover a world that we will call intersubjectivity, and it is within this world that man decides who he is and who others are".

Buber (1947) considered the individual in relation to the other in a dialogue. For him, the relationship was "in-between" the one and the other, between two persons:

There is a genuine dialogue - no matter whether spoken or silent - where each of the participants really has in mind the other or others in their present and particular being and turns to them with the intention of establishing a living mutual relation between himself and them.

(Buber, 1947, p. 19)

Although this conception of human relations and their fundamental nature, is also present in the works of Bateson (1973), Bruner (1977, 1990), and Stern (1985), among others, this view of human inter-relationship has been stressed most strongly and defined through analysis of mother-infant interactions by Trevarthen (1974, 1984, 1987, 1990, 1993a, 1993b). Primary intersubjectivity has been defined as the immediate experience of sharing subjective states (Trevarthen, 1979), and secondary intersubjectivity as the search for sharing of experiences about events and things (Trevarthen and Hubble, 1978). According to Trevarthen (1993), intersubjective encounters become "psychological interactions between selves" (p. 126).

The concept of intersubjectivity is important for the comprehension of infant's development because it helps us to see the new-born as a whole motivated being, not only as a chaotic one, with behaviour made up of reflexes. We are now beginning to understand that infants have a mental life, that they are particularly well-equipped for social life and eager to become part of it. The infant is born ready for intersubjective exchanges.

It is known that empathy of emotions is needed for communication because, emotion is both part of the meaning that the situation has for the

individual and part of the message for others. Empathy in the relationship between mother and infant appears to be the foundation for modulation of the infant's relationships to others that will develop afterwards. The first relationship, usually with the mother, is remarkable for the intensity with which it is affectively toned. It surely has a specially emotive quality for the infant, contributing for the self-regulation of the infant's mind (Schore, 1994).

Timing of expressions is the element that serves as a foundation for sympathetic engagement between mothers and infants. Beebe (1982) who has applied the methods of 'conversational analysis' to mother-infant interactions shows that there is a temporal organisation, a 'coaction' and turn-taking between mother and infant in their non-verbal communication. A synchrony develops between expressions of mother and child. And, surely, this synchrony is one expression of the affective bond between them. We could say that healthy communication first occurs through affection, that is, through expression of positive emotion. There is indeed a special rewarding quality, a valence, in the affection between infant and mother (Fiamenghi, 1997).

According to Trevarthen, emotions are 'intrinsically generated, central, regulatory states of the brain that unify awareness and co-ordinate activity of a coherent, mentally active subject' (Trevarthen, 1993, p. 48), and emotions also communicate between subjects. He believes that at 2 months, infants may become involved in *protoconversations*, as a first step towards communicative exchanges. Protolanguage, with its intricately timed reciprocal behaviours, "requires that a child has a clear differentiation of an integrated *self* from the world of *others*" (Trevarthen, 1987, p. 182).

This view agrees with Stern's point that "preverbal senses of self start to form at birth, if not before" (1985, p. 5). He defines 'self' as an invariant pattern

of awareness that arise only on the occasion of the infant's actions or mental processes. Senses of self are essential to daily social interactions. Examples of senses of self are sense of agency, sense of physical cohesion, sense of affectivity, sense of a subjective self that can achieve intersubjectivity with another, and so on.

According to Trevarthen (1984), infants are coherent beings at birth. Actually, even inside the womb, the foetus is able to detect, react to, and learn about the mother's vocal features. In consequence, the infant may show, a few hours after birth, preference for the mother's voice compared to the voice of any other woman. An infant may be alert and responsive immediately after birth, being particularly sensitive to gentle vocalisations and stimuli associated with holding in the lap, including smell, warmth, rocking and soft tactile stimulation. New-born infants can be calmed through the use of the mentioned stimuli. When mothers try to communicate with the new-born, they slowly repeat a series of brief questions about the infant's impulses and feelings. All this speech may be considered as an automatic trial to explain or make a comment on an intense identification or empathy with the infant's motives, especially those that seem to be directed to the communication with the mother.

Trevarthen (1993) points that there are five principles of emotion to be tested in infants: coherence in one subject, meaning that emotions set limits and directions for coherent awareness; autonomic regulation of the body, that is, emotions coordinate and organise all the body's functions; cognitive regulation of the conscious self, that is, emotions are involved in cognitive evaluations of objects and events of the outside world and judgements of experiences; communicative regulation of self-other relations, meaning that emotions are communicated between subjects and coordinate their motives; and essential

intersubjective valence (sympathetic equivalence), meaning that emotions can change other person's feelings and motives.

Concerning emotional development, we may say that it is a very special process because it is through emotion that people express both their changing inner feelings and their changing relations with the environment. Emotions are not only products of development, they regulate the processes of development and learning.

3. A REVIEW OF LITERATURE IN INFANTS' PEER INTERACTIONS

We are always involved in some kind of emotional process, although we may at times try to disguise its expression. We may not express the emotion, but we are surely living it inside our bodies. In fact, movements of our bodies effectively communicate our inner states. Words, seem comparatively poor expressions of inner feelings. Before we say anything, people are aware of gestural and facial expressions that display what we are living inside, in our inner world. Some psychotherapists, as the bioenergeticists, work with the body expressions to show the patient the kind of emotion he is living at the moment and what unexpressed motives can cause in him.

Frijda (1982) says that emotional expression functions to transmit information about a person's emotional state, and that it is interactive, because this state will elicit an other's response to that emotion. In this way, emotional expression is communication. For example, when discussing the ontogeny of vocal communication, Papousek (1992) says that "communication is viewed as a sequence of interactional processes where both partners act as communicators and recipients and where each of them obtains and provides different types of information, with different vocal means and different function gains " (p. 231).

This kind of direct communication of motive states and processes is much more genuine in children. They express what they are feeling: happiness, distress, anger, curiosity. Infants, not able to speak, must express all their emotions through channels other than the verbal one. Even new-born infants express differentiated self-defining emotions, as was demonstrated by Wolff (1987).

We will not find any expression of interpersonal feelings so authentic as those of young children. For example, when a stranger tries to communicate with a 6-month-old baby, the baby will probably cry or withdraw, although the same baby will be an active player in communicating with his mother (Trevarthen, 1984).

Imitation, as a direct indicator of sympathy between persons, has become an important topic in research in infants' development and communication. It is now proven that imitation exists from birth, and many researchers are exploring the full range of mother-infant communication, including the functions of the infant's imitation of the mother or other partners in communication (Kugiumutzakis, 1993; Maratos, 1973; Meltzoff, 1985; Meltzoff & Moore, 1989; Nadel & Fontaine, 1989; Nadel & Pez , 1993; Nagy & Moln r, 1994; Vinter, 1985; etc.). Other authors are studying the role of playing and teasing as a means of negotiating affective relationships between mother and infant (Nakano, 1994, 1995; Reddy, 1991). Nakano considers 'benign teasing' a way of creating mutual amusement between mother and infant. He says that affectionate teasing is a very good example of the dynamic processes of intersubjectivity and the way they contribute to the development of communication.

Some authors, such as Fogel (1992, 1993; Fogel & Thelen, 1987) emphasise a new epigenetic of theory of emotional development, the Dynamic Systems Theory. This theory states that expressive and communicative actions are organised as complex, co-operative system with other elements of the infant's physiology, behaviour, and social environment. Although this statement of general principles is a welcome corrective to over-simple concepts of innate causes or learning, the theory of Fogel and Thelen (1987) takes a rather

reductionist position that could minimise the contribution of psychological functions in early stages. They declare that communicative development in different parts of the system is asynchronously timed and that individual actions "often develop within functional systems that are not, at the outset, related to communication or expression. Coordinative structures that are precursors to communicative skill can be found early in life in systems serving respiratory, arousal regulatory, locomotor, and exploratory functions." (Fogel & Thelen, 1987, p. 754).

I do not agree with this point of view, because I think that many of the actions of very young infants here classified as serving physiological functions aim to some kind of communicative effect, and that human beings are involved in true psychological communication from birth, not adequately characterised as the mutual regulation of 'coordinative structures'. Actually, it seems to me that a capacity for sympathetic emotion is primary in the control of patterns of communication, that it *is* the coordinative system. This is easily seen in the examples of early imitation and of mother-infant communication (Kugiumutzakis, 1993; Maratos, 1973, Nagi & Molnàr, 1997; Trevarthen, 1993; Vinter, 1985). I hope that my research into infant-infant communication will produce additional evidence of the motives for communicative exchanges at early ages.

Some researchers looking beyond mother-infant relationships, have decided to investigate peer imitation (for example, Hanna & Meltzoff, 1993; Patrick & Richman, 1985), in the belief that this kind of interaction would provide answers to questions about the source of coordination. In this kind of situation, infants are involved in relationships with strangers who are,

moreover, no more developed, skilled or sophisticated than themselves. The following studies have brought new insights into the field of human development and emotion.

Some studies have demonstrated that new-borns have sympathetic responses: they can be distressed and cry when listening to other babies' crying (Simner, 1971; Sagi & Hoffman, 1976; Martin & Clark, 1982).

Fogel (1979) studied 18 infants (7 boys & 11 girls); between 5 and 14 weeks, observing the occurrence and non-occurrence of multiple behavioural categories: 'gaze', 'facial expression', 'limb movements', and 'body position'. Each mother held her infant vertically against her chest, supporting the infant under the buttocks with one arm and around the chest with the other arm. His results show that the 18 infants, as a group, presented stable differences in behaviour to mother and to peer. The "Peer" condition evoked more intense staring with occasional strain forward movements of the head, apparently to get a closer look at the other infant. Infants behaviour to the strange peer had an intense, unbroken quality. Eyebrows were typically relaxed with a minimum of facial movement. Limb and body movement was rare, but when it occurred, it had an abrupt or jerky tempo. Fogel draws attention to the fact that the "Peer" condition in this study included the mother as an aware and interested onlooker, and concludes that the results must be interpreted with caution because it cannot be sure they show genuine peer-directed behaviour.

Vandell, Wilson & Buchanan (1980) studied 32 firstborn infants (16 male and 16 female), observed at 6.5, 9.5 and 12.5 months, in 8 girl dyads and 8 boy dyads, each seen nine times, each 15 min session divided in two parts: toys present (10 min) and toys absent (5 min). The authors wanted to observe peer interaction in the first year of life and its sensitivity to toys. They defined

Socially directed behaviour (SDB) as a discrete act accompanied by a look to the head of a peer. Their results showed that most common sequence type at all three ages was a form of "SDB—>SDB". The content of infant-peer social behaviours indicated the strongly prosocial and vocal nature of the sequences; interaction frequencies and duration were greater in the absence of toys. Also, while the infants were more socially active in the absence of toys, this condition had to be terminated earlier than the toys-present condition because the infants were more likely to become distressed (although no explanation was offered for this event). In contrast, many infants could have continued the toy session longer than they were permitted to do so. The authors conclude that growth in social skills requires the presence of familiar peers. No sex differences were found.

Hay; Nash & Pedersen (1981) studied 24 infants, averaging 6.3 months of age, and equal number of boys and girls (each infant paired with the same gender), for two 10-min trials. They wished to investigate the reactions of six-month-old infants to the distress of their peers. Their results showed that the first infant to become distressed was more likely than not to continue showing distress from interval to interval; if one infant was distressed in a given interval, the other infant was less likely than not to be distressed in the next; the infants occasionally responded to their distressed peers in other ways as well, by leaning toward, gesturing toward, touching, or otherwise contacting the peer. They explain their results with the concept of *empathic arousal*, saying that, for older individuals, it increases systematically with the magnitude of pain or discomfort shown by others. The main question here is related to the concept of empathy. It seems to have a negative meaning. Why? Empathy does not have to have such an evaluation, negative or positive.

Empathy (or sympathy) is aroused by pain or discomfort but also by partners in joyous, happy and interested, questioning states.

In another study, Hay, Nash & Pedersen (1983) videotaped 24 infants (12 girls and 12 boys); 6.5 month-old, to observe infants reactions to touching either the other infant, or toys in their possession (positive or negative reactions), and the social influence across time periods of different length. Their results show that contact episodes occurred more often when toys were absent; that an infant who initiated one episode of peer contact was not reliably more likely than the recipient of that episode to initiate the next. They also demonstrate that the total time spent contacting peers' toys was reliably greater for boys than for girls.

Jacobson (1981) observed 23 infant dyads (13 male; 10 female), seen longitudinally over a 4.5 month period. Each dyad met on an average of about once per week, alternating between the two infant's homes and in the laboratory, for free-play sessions (scheduled at 10, 12, and 14.5 months). Two 20-min sessions were held at each age: one with a familiar peer and the other with an unfamiliar infant of the same age and sex. He wanted to observe if acquainted infants would exhibit more sophisticated social exchanges; if object-centred contact would facilitate the development of social interaction, and if certain interactive competencies originate during object-centred contact. His results show that object centred contact was extensive at all ages. At 10 months the modal interaction was a two-act sequence, during which the infants often seemed to be checking each other. By 14.5 months, most of the interactions were made up of three acts or longer, reflecting growth in the children's ability to sustain mutual visual attention. The amount of experience with peers had no apparent effect on the development of social interaction, and prior peer

experience was unrelated to frequency of both short and long social interactions. This is important evidence that infants are able to engage in social interactions without learning to do so. The infants engaged in more manipulative play and less social interaction when the familiar peer was present; the interest in toys is apparently diminished by the presence of a novel peer; between 10 and 12 months the frequency of long interactions increased significantly in both object-centred and non-object-centred situations; long social interactions occur relatively more frequently in play sessions with the unfamiliar peer; brief exchanges in the absence of toys are common at 6 and 8 months. Most importantly, even limited experience with peers is sufficient for the development of the ability to engage in sustained social interaction.

Adamson & Bakeman (1985) observed 28 infants, seven males and seven females, in two cohorts (Cohort 1: observed at 6, 9, 12, and 15 months; Cohort 2: observed at 9, 12, 15, and 18 months). All observations were videotaped in the infants' homes during a 1.5-2-hour-long visit, and the sessions consisted of 10 min. videotape sessions in each of three conditions: alone; with the mother, and with the peer. The authors defined engagement states ('person engagement'; 'object engagement'; 'passive engagement'; 'joint engagement'; 'co-ordinated joint engagement'; 'unengaged'; 'onlooking') and expressive events were also coded ('gleeful squeals' [not every vocalisation], 'broad smiles' [not subtle modulations of facial expressions], and 'excited arm waving' [not limb movements related primarily to object exploration]). They expected affective displays to be frequent during periods of person engagement, as they presumably are during the first half year of life; expected them to be relatively infrequent when infants are engaged only with objects, are unengaged, or are just onlooking. Their results show that:

a) Affective rates were higher with mother than with more observant peers. With increasing age, the rate of affective expressions and the percent of affective expressions containing vocal elements increased.

b) Neither sex, nor parity, nor interactions between these factors affected the scores in any consistent way.

c) The amount of peer contact in the previous month had no systematic effect.

d) Affective expression was equally likely to occur when infants were coded in 'person engagement' with either partner, or in 'passive joint engagement' or 'co-ordinated joint engagement' with the mother.

They conclude that with partners as different as mothers and peers, infants continue to use affect as greetings and as central themes in interpersonal exchanges, and that infants as young as 6 months of age engage each other in purely social exchanges.

As Nadel (1986) shows in her work with imitation between toddlers, imitation may be a way of starting an interaction. It allows one of the children to perceive that the communicative partner is interested on her (or him) and thus, to respond to this invitation to communicate.

All of those findings indicate the importance of studying all forms of emotional or purposeful expression in infants' development, and not just expressions that might relate to language (speech and gesture).

4. A REVIEW OF LITERATURE IN GENDER DEVELOPMENT

Gender research is one of the most controversial fields in Developmental Psychology nowadays. Basically, there are two positions among developmental psychologists: those who believe that there are gender differences between boys and girls, and those who believe that gender differences is only a cultural issue, a consequence of social conditioning.

The following is a summary review of the main points researched in gender development to this moment.

The most difficult task for those who believe in gender differences is to find proof. It is very hard to identify and set aside differences due only to cultural factors, when those are so widespread in people's lives, from birth.

In gender research, the 'gender stereotype' is a very important concept. Gender stereotype is a group of socially inculcated beliefs about how a male or a female must behave. In fact, gender stereotypes do seem to guide parents' relationships with their children. Actually, even parents who believe that they are not making any distinctions according to gender, do make them.

Children seem to be more strict in labelling themselves and the others as male or females (Signorella, Bigler, & Liben, 1993). This starts to happen around two years, which is fairly early, but a child has already had the opportunity to be impressed by cultural beliefs by this age.

Chodorow (1978), reinterpreting Freud's theory believes that gender is biologically defined, and women are more oriented towards relationships. This is a consequence of women being the ones who conceive, carry and give birth to the baby. She believes that girls develop a personal identification with the mother, with a consequent tie between affective processes and role learning,

whereas boys develop a positive identification with aspects of masculine role and, as a result, in them the tie between affective processes and role learning is broken. This appears a very odd assumption, when one considers Murray's (1992) study with children raised by post-natal depressive mothers. Her results showed that boys are more affected than girls by mothers' post-natal depression and deleterious effects can still be seen when the boys are 6 years old. The fact that emotional disorders in mothers cause emotional and intellectual disorders in their sons proves that boys are not quickly separated from the mother, defining themselves as separate individuals, as Chodorow thinks.

In a study of traditional and nontraditional mothers' communication with their daughters and sons, Weitzman, Birns and Friend (1985) showed that mothers verbally stimulate their sons more than their daughters, regardless of their attitudes toward women's rights and roles. Although they think that the absence of traditional/nontraditional effects could be explained by limits in the methods of assessment of their subjects, they discuss the fact that attitudes and behaviour are two different things and when it comes to action, there are forms of behaviour which are very deeply motivated and rigid.

Weisner and Wilson-Mitchell (1990), when comparing nonconventional family styles and sex typing in six-year-olds reported significant differences. They showed that children in sex-egalitarian families displayed less stereotyping in their activities and interests, when compared to those of traditional families. However, all children acquired the conventional model of sex roles and sex typing, regardless of family style. These authors conclude their study as follows: "if children in the more egalitarian, nonconventional families carry on their parents' egalitarian beliefs, they will need to do more than mimic their parents' gender schemas in isolation from their wider cultural

meaning" (p.1931). They also reported that, for the parents, even in the most sex-egalitarian families, there seems to be a limit, that is, there remain activities that they handled differently for girls and boys.

Maltz and Borker (1983) studying boys and girls groups concluded that boys interrupt one another more often, use commands, threats, refuse to comply with another child's demand, tell jokes, call another child names, in their groups, whereas girls express more agreement with the other speaker, pause to give the other girl a chance to speak, and acknowledge points made by other speakers. Miller et al (1986) say that boys use threats and physical force, while girls use more 'conflict mitigating' strategies to solve conflicts. Leaper (1989) showed that boys' speech acts are commanding and include negative reciprocity, whereas girls' speech are more collaborative, with positive reciprocity. Sheldon (1989) says that girls successfully pursue their ends, but they do so softening their voice pitch, trying to bring agreement, and maintaining group functioning. These results support the common sense view that girls are more oriented to mutually supportive and peaceable relationships with their peers.

Maccoby's report on gender and relationships (1990) mentions that boys and girls engage in different kinds of activities, being boys playing in larger groups, needing more space to play and playing rougher, whereas girls tend to play in private homes or yards. Also, girls friendships are more intimate and marked by the sharing of confidences, whereas boys friendships are more oriented to mutual interest in activities.

Rogé and Ionescu (1996) suggest that different behaviours displayed by males or females are the starting point of an evolutionary system and further influences will be based on them. They think that it is through an infant's

behaviours that the infant builds the categories and the system by which he or she will be referred to.

All of the preceding researchers have studied children, not infants. Their results are, therefore, open to the interpretation that culture is the only factor responsible for gender differences. The children are old enough to have learned.

Nevertheless, although the influence of culture cannot be denied, it seems that some innate factors are also responsible for these differences. Otherwise, results like those obtained with nontraditional families should have shown more consistent similarities between boys and girls. As Golombok and Fivush (1994) say "gender is not simply something that is imposed on children; at all points of development, children are actively constructing for themselves what it means to be male or female" (p. 111).

The best way of trying to show such differences is to study younger infants, who are not likely to be influenced by cultural factors, and to observe how differences between boys and girls, such as those described above, will emerge. This will not disprove the cultural determinants of gender behaviour, but will attach to it an innate component, that cannot be left behind in future development.

5. A REVIEW OF THE LITERATURE IN MIRROR INTERACTION

Mirror studies have, for the most part, been concerned with the question of which is the age when children finally recognise themselves. This appears to be the main concern in all studies using mirrors, and sophisticated and elaborated arguments are put forward to prove that infants cannot recognise themselves in the mirror before 18 to 22 months of age. The majority of the studies defend the use of a surreptitiously placed nose mark as a trustworthy test of self-recognition.

Amsterdam (1972) says that, from 6 to 12 months, infants think of their mirror image as a playmate. She believes that, when the child climbs the mirror or looks behind it, she (or he) is curious about either the nature of the mirror or the presence of the image. Self-admiration is also not recommended as a reliable sign of self-recognition, because the child may either be imitating an adult behaviour or responding to the presence of others. For this author, "the only established fact is that the child in some way associates his (or her) own face with the face in the mirror after 18 months" (p. 304).

Zazzo (1993) is a pioneer, who seems to have investigated all aspects of mirror interaction. He studied infants from 10 months on, and twins, with mirror and glasses, and concluded that effective mirror self-recognition will happen at 20 months or "24 months, being prudent" (p. 153), because the infant touches the rouge mark on his nose. For him, although the child plays with the mirror image of her (or his) hands, she (or he) does not recognise herself or himself. This conclusion is based on the nose dot rule. Zazzo thinks that the child recognises his or her hands, clothes, and so on, before recognising himself or herself.

Asendorpf & Baudonnière (1993) argue that self- and other-awareness are closely linked because both require a cognitive capacity for *secondary representation*. Mirror self-recognition, on the other hand, requires "coordinating a mirror image (primary representation) with one's objectified self (secondary representation)" (p. 89). As such, they studied 19-month-old children who had passed the mirror test (self-recognition indicating by touching the nose dot) who were observed in pairs, playing with sets of duplicate toys. They concluded that mirror self-recognition is associated with sustained synchronic imitation as a form of preverbal communication with an unfamiliar peer.

Lewis, Sullivan, Stanger & Weiss (1989) think that secondary emotions only appear after the development of specific cognitive skills, like self-other differentiation, object permanence, and self-referential behaviour. Using the nose dot as a sign of self-recognition, and observing infants aged from 9 to 24 months, they tried to discover the relation between self-recognition and embarrassment and wariness. They think that "the ability to consider one's self - what has been called self-awareness or referential self - is one of the last features of self to emerge, occurring in the last half of the second year of life. The ability to consider one's self rather than the ability to differentiate or discriminate self from the other is the cognitive capacity that allows for all self-conscious emotions such as embarrassment and empathy" (p. 154).

Contrary to that, Stern (1985) discusses the concept of self, saying that senses of self exist prior to self-awareness. For him, "the sense of self and its counterpart, the sense of other, are universal phenomena that profoundly influence our social experiences" (p. 5). Stern defines four senses of self, *emergent self* (from birth to two months), *core self* (between two and six months), *subjective self* (between seven and fifteen months), and *verbal self* (after fifteen

months). He argues that the sense of self "serves as the primary subjective perspective that organises social experience" (p. 11). He thinks that senses of self are essential to daily social interactions. But, the most important, Stern says that infants begin to experience a sense of an emergent self from birth, being pre-designed to be aware of self-organising processes and "they never experience a period of self/other undifferentiation. There is no confusion between self and the other in the beginning or at any point during infancy" (p. 10).

Analysing some of the current research on self-consciousness, Reddy (1994) argues that "to look for the earliest origins of self-consciousness one needs to look not at the infant's attention to the self, but at the infant's attention to the other. In other word, to look for *self*-consciousness, one needs to start with consciousness of *other* " (p. 3). This point of view agrees with the intersubjective approach, which is the bedrock for this thesis (as was discussed before).

6. PURPOSES OF THIS STUDY

This research was designed as an attempt to test a new methodological approach to infant-infant interaction. The usual face-to-face paradigm was used, but with a different setting. Pairs of infants were seated on their push-chairs, which were placed with their front wheels touching, in order to encourage face-to-face interaction without physical contact. Using two video-cameras, eye gaze could be monitored without the need of sophisticated equipment, since it was guaranteed that the infants had nothing but the other infant to look at when facing straight ahead. With this arrangement, it was easy to register and distinguish gazes to other parts of the room and to the mother.

As a methodological "pilot" study, the principal question that this research aimed to answer was " Do infants get involved in intersubjective exchanges with same age peers?". If such interactions did occur, other points would be clarified, as well:

1. Is this communication emotionally toned? That is, do infants show the same kind of emotions to peers as they show in interactions with their mothers?

2. Dependence on 'scaffolding' from the mothers for communication would be disproved. As the infants were left in front of each other, their mothers though present, were out of sight and keeping silent, and were not able to give any hint on how the interactions could be developed.

3. Is the communication similar to or different from mother-infant interactions, in quality and in amount.

Detailed analysis of a small number of subjects, who could be easily contacted and monitored was preferred to less detailed measurements of the

behaviour of a larger population of infant pairs. This reduces the generalizability of the results. Nevertheless, infants are normally capable of many interactive exchanges within a short time, once communication is established, so it was expected that statistically significant results would be obtained, proving the capacity of infants for supporting organised engagements with age-mates.

A supplementary mirror reactions study gave additional data on the expressive capacities of infants and their role in interactions with an infant image.

An original coding system was developed in four different subsystems, derived from microanalysis of the behaviours of the infants.

The idea was not to have an *a priori* code, but to construct a behavioural account as the videos were analysed. The other functional categories were constructed out of this first behavioural one, by collapsing terms into broader categories.

The main point, then, was to test a methodology to show that infants are really able to communicate with each other from an early age.

In the course of the research, questions arose concerning gender differences, types of emotional expression and the function of imitation in infant-infant communication.

Chapter II

METHODS

1. Subjects

Letters were sent to volunteers from a list in the Department of Psychology. From 16 letters sent to families meeting the first criteria (boys and girls aged from 6 to 9 months), 12 answered positively and appointments were made to see each one and to explain the research. A copy of the letters sent to the families is presented in Appendix 1.

All families were middle-class. At the time of the research, six mothers were working part-time and six were housewives .

Of the twelve subjects, 10 infants were first born, 2 were second born. Two were born by caesarean section; one by induced labour; three with forceps and six were normal deliveries.

The infants were divided according to their ages in weeks, to form three groups:

Age Group 1 (6 months): ages 20-25 weeks: 4 subjects; 2 boys (A; D) and 2 girls (E; K).

Age Group 2 (8 months): ages 31-36 weeks: 4 subjects; 3 boys (T; J; M) and 1 girl (H).

Age Group (9 months): ages 37-42 weeks: 4 subjects; 3 boys (S; A; An) and 1 girl (E).

Subjects	Abbrev. Names	Age (weeks)	Sex	Birth order	Working mother	Delivery
Ellen	E	20-25	F	1st	No	Normal
Catherine	C	20-25	F	2nd	No	Forceps
Andrew	A	20-25	M	1st	Yes	Caesarean
David	D	20-25	M	1st	No	Forceps
Holly	H	31-36	F	1st	Yes	Normal
Monty	M	31-36	M	1st	No	Normal
Thomas	T	31-36	M	1st	Yes	Forceps
James	J	31-36	M	1st	Yes	Caesarean
Emily	E	37-42	F	1st	No	Normal
Adam	A	37-42	M	2nd	Yes	Induced
Angus	An	37-42	M	1st	Yes	Normal
Stuart	S	37-42	M	1st	No	Normal

Table II.1: Subjects' characteristics. Abbreviations in bold are from girls' names.

In arranging dyads for recording, an attempt was made to pair all possible combinations within each group. However, there were some exceptions: in Age Group 2, a boy (M) was not recorded with another boy (J), because of his mothers' difficulties to find a time for meeting, and in Age Group 3, boys (An and A) were not brought together.

An attempt was also made to record the same age infants on the same day, as a convenience for the mothers. At the end of the sessions, the following recordings had been achieved:

Age Group 1 (6 months):

E+K: 3 recordings

E+A: 3 recordings

E+D: 3 recordings

K+A: 3 recordings

K+D: 3 recordings

A+D: 3 recordings

TOTAL: 18 recordings

Age Group 2 (8 months):

H+M: 1 recording

H+T: 1 recording

H+J: 1 recording

T+J: 1 recording

M+T: 1 recording

(M+J: not recorded)

TOTAL: 5 recordings.

Age Group (9 months):

E+A: 1 recordings

E+S: 1 recordings

E+An: 1 recording

S+An: 1 recording

S+A: 1 recording

(An+A: not recorded)

TOTAL: 5 recordings.

Each family received a copy of their child's video, and travel expenses to University were paid.

2. Methods

2.1. **Cross-Sectional and Longitudinal studies**

The recordings were made in the Department of Psychology, at the University of Edinburgh.

A "recording room" was specially prepared for the recordings. A diagram is showed below:

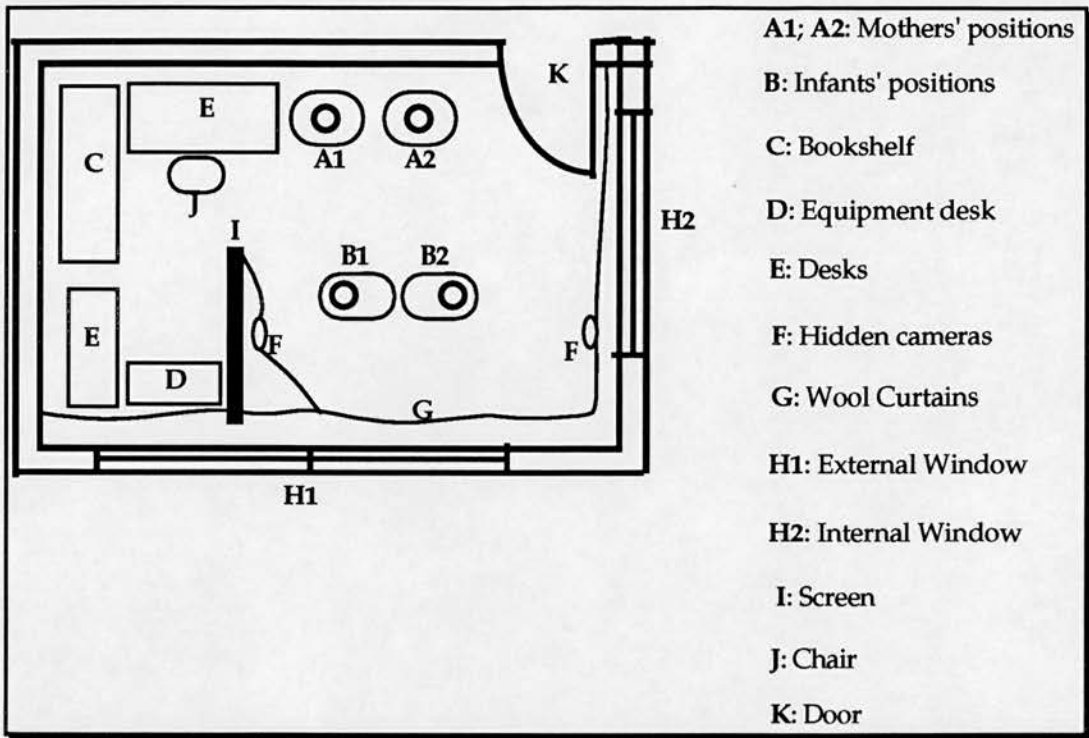


Fig. 1: Diagram of the "recording room"

Two professional video-cameras (Panasonic WF10), a video-recorder (Panasonic NV180), a mixer (Panasonic WGMX12), which produced a split-screen image, and a TV monitor (Panasonic TC801), which helped to control the recordings were used. This position of the equipment is illustrated above. Heavy wool curtains covered the windows, to keep the light level constant.

The recording procedure is described below:

As soon as two mothers arrived, they were led to the recording room and the position of the push chairs was fixed. The push-chairs were put facing each other, with their wheels touching, to make sure that the babies would have a frontal gaze at one another.

The mothers were instructed to sit nearby (A1 and A2 positions in the diagram above). They could intervene to help their babies to a more comfortable position and they could chat quietly to one another. They remained

present during the recordings to give the infants reassurance. Indeed, the infants did not seem to be distracted by the mothers' presence, because, compared to the time each spent gazing to the other infant, the percentage of time spent gazing in their direction was very small.

After setting the focus of both cameras, fixing the push-chairs' and the infants' position, the video recorder was turned on and the infants were observed behind the screen, through the TV monitor (I, in the diagram above).

Recording was continued until either of the infants started to be restless, grumpy, or crying, when the recording was stopped and another dyad was brought in. This "free time" recording rule was used because there was a feeling that infants have a definite time perception and if interactions between them were to be observed it should be permitted them to take their time. In fact, some of the recordings lasted fifteen minutes, while others, just one or two minutes.

While the first dyad was being recorded, the second dyad was in the "waiting room" where, normally, the mothers were either feeding or changing the infants. As soon as the first recording finished, one of the infants was taken to the "waiting room", and another was taken to the "recording room". This way, there was a rotation of dyads in each age group. All the subjects in each age group were recorded with each other, with the exception of the cases described above.

The youngest age group (20-25 weeks), was followed for 4 months, the last monthly recordings being made when the infants were 37 weeks old. This longitudinal study was made to observe age changes within this group. Thus there are also more recordings in this age group (3 of each dyad).

With the second age group (31-36 weeks) and with the oldest age group (37-42 weeks) one recording of each dyad was made.

2.2. Mirror study

Again, the recordings were made in the Department of Psychology, University of Edinburgh.

A special mirror box was made for the recordings. It consisted in a sheet of thick glass covered with silver film, to make it like a one-way mirror. A black cardboard box was made, with two fluorescent lights in each front side and a small hole in its back, through which a camcorder was inserted. This way, a total image of the infant was recorded. The final box resembled a big television monitor. This box was placed on a low table and the researcher was seated behind it, invisible for the infant.

A Panasonic Camcorder NV S90-B was used, with an external microphone attached, to obtain better sound quality. The infants were recorded facing the mirror, either seated in their push-chairs (when not able to crawl), or seated on the floor (when already crawling). The mother was seated on the right side of the infant, to give reassurance if needed. Two mothers held their babies, who, if left unheld, were very unsettled.

Recordings started as soon as the infants were put in front of the mirror box and last more or less 10 minutes (depending on the infants), until the infant refused to interact, being fussy or crying. At the end, one subject from Age Group 3 was not recorded because his mother was unable to bring him to the University again.

A diagram of the mirror box is shown below:

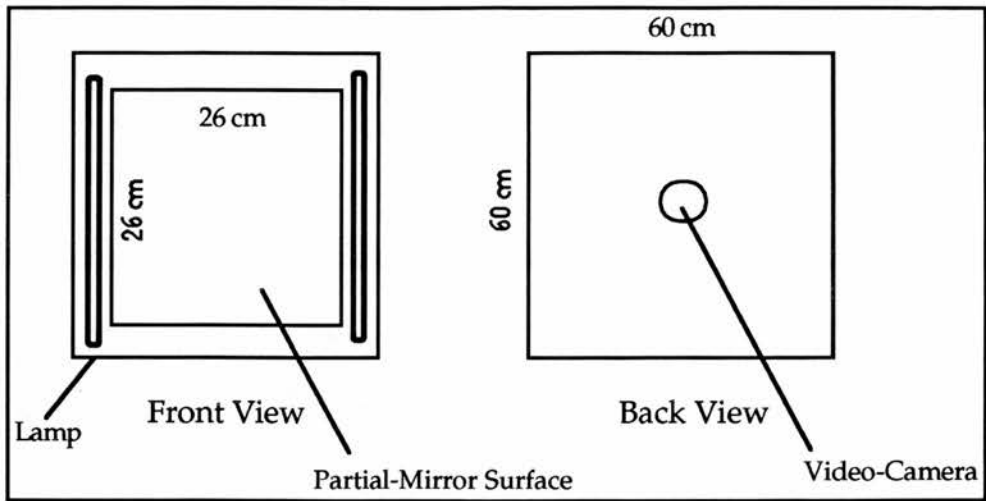


Fig. 2: Diagram of the "Mirror Box"

3. Analysis and Coding

Videos were first copied with a digital clock added (showing hours, minutes, seconds, and milliseconds), to facilitate the work of coding the behaviours. All the videos were viewed and a log of recordings was made, noting the approximate time of all interactive episodes (defined above).

Interactions were found to occur in 25 sessions, but in order to make the sample more balanced, one subject was dropped, in each group, making all the three age groups look exactly the same, with one girl and two boys, for the Cross-Sectional Study.

Therefore, in the Cross-Sectional study, nine sessions were taken for further microanalysis, in each age group:

Age Group 1 (6 months): 3 (out of 18)².

Age Group 2 (8 months): 3 (out of 5).

Age Group 3 (9 months): 3 (out of 5).

In the Longitudinal study, which involved only the Age Group 1, all 18 sessions were taken for further microanalysis, 6 in each age (when the infants were 20-, 31-, and 37-weeks-old) and the four subjects were included (two boys and two girls).

In the Mirror Study, 9 infants were analysed, 4 in Age Group 1, 3 in Age Group 2 and 2 in Age Group 3.

The selected videos were then observed frame by frame, with a Panasonic VCR (AG-6200) and a Panasonic 21" TV monitor (TX21SIT). The sample chosen for quantitative micro-analysis in each interaction was a single 2 minute period, from the first moment that the infants gazed at each other³. The behaviours were coded directly to Claris Works spreadsheets for the Macintosh with a Power Mac 8200 computer. Then, the data were copied to SPSS, for statistical processing.

Statistical Analysis:

The statistical procedures used in this research were carefully chosen, after a long period of study and reflection.

The data analysed is basically nominal, and, as such chi-squares were the statistical tests chosen, although there was an awareness of the fact that, being a parametric measure, chi-squares may show some weaknesses, mainly with small samples, which is the case here.

² At this Age Group, the first session was taken for each dyad.

³ For an explanation of the coding procedure, please see Chapter III - The Coding System.

To take care of that, a loglinear analysis was also performed in each study. Loglinear analysis searches for a best fitting model that can explain the differences between the expected frequencies and the ones actually observed in the data. As a result, chi-squares appear in a much more reliable form and also likelihood ratios are shown, when needed.

A loglinear analysis was performed, then, for all the three studies, with chi-square tests and likelihood ratios, when relevant. The approach used was a general loglinear nonsaturated model, that does not distinguish between independent and dependent variables, treating all alike and exploring all the possible associations among them and, being a nonsaturated model it also has the qualities of parsimony and simplicity.

Chapter III

THE CODING SYSTEM

1. Defining a System for Analysis

Before deciding what kind of code would be most appropriate, an extensive review in the coding systems literature on infants' interactive behaviour was made.

The first clear difficulty was that most previous studies of infants' communication were concerned with mother-infant interactions, not infant-infant interactions. Those few that dealt with infants were in most cases very narrowly specific in the kinds of behaviours they intended to record.

Mueller and Lucas (1975) defined Socially Directed Behaviour (SDB) as any discrete act accompanied by a look to the head of a peer. Vandell, Wilson, and Buchanan (1980), recorded 6-month-old infants, using that definition of Socially Directed Behaviour (SDB). They accordingly recorded the following acts: a) *vocal*: any sound except cry, cough, sneeze; b) *agonistic*: hit, push; c) *gesture*: ex., point; d) *cry*: includes frets; e) *touch*: ex., pat; f) *smile*; g) *object related social act*: ex., offer, show, take; h) *large body*: ex., flap arms, clap; i) *approach*: come within 2 feet.

Jacobson (1981), working with 10-, 12-, and 14-month-old infants, used a SDB (Socially Directed Behaviour) code, following the definition of Mueller and Lucas (1975). Jacobson's aim was to observe the role of inanimate objects in early peer interaction, and he concluded that "early peer contact is primarily object centred, that is, the infants focus their attention on a common toy, rather

than on each other" (p.60). This statement may be true of older infants (after 10 months of age) in certain situations, but infants, including younger ones show direct intersubjective interactions, without objects.

Hay, Nash, and Pedersen (1981) working with 6-month-old infants, recorded only Distressed Vocalisations, defined as sounds ranging from whimpers to loud, sustained wailing. Later, the same authors (Hay, Nash, and Pedersen, 1984), again with 6-month-old infants, observed a limited subset of behaviours, which they called Interactive episodes: touching the other or touching a toy in his or her possession. They also recorded the reaction of the infant as he or she was touched. These authors stated that they were "concerned about imputing intentionality to the behaviour of persons so young and thus did not assume that all acts accompanied by gazing at the peer are necessary 'peer-directed'...Rather, we simply asked what infants characteristically do when their peers impinge directly upon them, by touching either the infants themselves or toys in their possession" (p.557).

This appears to be an arbitrary restriction of interpretation. There is a clear difference in 'intentions' when an infant is gazing at another infant and making efforts to establish any kind of communication, and the case where an infant is reaching after or taking another infant's toy. The first manifests a communicative purpose, while the second is either deliberately intrusive, or disregarding the other subject.

Adamson and Bakeman (1985), defined Engagement States (between 6- to 18-month-old infants) as *person engagement; object engagement; passive engagement; joint engagement; co-ordinated joint engagement; unengaged and onlooking*; they also coded: *gleeful squeals* (not every vocalisation), *broad smiles* (not subtle modulations of facial expressions), and *excited arm waving* (not limb

movements related primarily to object exploration). According to the authors, their coding system was designed to describe infants' attention, and this coding segments the infant's attention over time.

Kaye and Fogel (1980), analysing interactions of 6-, 13-, and 26-week-old babies with their mothers, used behavioural categories, such as Head Orientation (toward, peripheral, away); Eye Quality (closed, dull, alert), Facial Expressions (cry, smile, wide, vocalisation, laugh), and Combinations (attention, greeting).

Subsequently, Fogel and Hannan (1985), studied 9-month-old infants, using a different set of categories: Face (smile, cry, norm, mouthing), Vocalisation (vocalising, non-vocalising), Gaze (at and away), Hands (point, spread, grasp, curl).

Weinberg, and Tronick (1994) use the categories of their IRSS (Infant Regulatory Scoring System): Social Engagement: the infant looks or glances at the mother's face; Object Engagement: the infant looks at or manipulates an object for two seconds or more; Scans: the infant glances at objects or around the laboratory without focusing on an object for more than two seconds; Vocalisations: the infant vocalises with 1) neutral/positive, 2) fussy, or 3) crying vocalisations; Gestures: the infant 1) gestures to be picked up or 2) moves his or her arms or legs in an organised manner in the direction of the mother (e.g. reaching); Self-Comforting: the infant self-comforts by 1) sucking on his or her body, e.g., thumb sucking or 2) sucking on an object, e.g., the chair strap; Distancing, Escape/Get Away: the infant attempts to distance himself or herself from the mother by turning, twisting, or arching his or her body in the infant seat; Autonomic Stress Indicators: the infant exhibits behaviours that indicate autonomic arousal such as spitting up, hiccupping, or tonguing;

Inhibition/Freezing: the infant inhibits his or her perceptual, motor, and/or attentional processes to minimise engagement with the mother and the surround, e.g., the infant is glassy-eyed. They also use the AFFEX System (Izard & Dougherty, 1980), which identifies 10 discrete emotions as well as blend of emotions: *interest, joy, surprise, sadness, anger, contempt, fear, shame/shyness/guilt, distress, disgust*.

The IRRS is a very comprehensive coding system, but, as will be explained, it seemed that certain specific forms of interaction between infants observed in the recordings of this study were missing in the IRRS.

From this review, it was clear that each of the above authors has chosen what he or she believes is the best coding system for the chosen theoretical objectives and the data desired. Hence, after pondering these other systems, it was decided, as the other authors had done, to create a new coding system, one which would allow us to account for differences between this work and others, and which would best fulfil this study's specific needs.

The four category systems are explained in detail below. After each behaviour, the abbreviation by which the behaviours were identified in the spreadsheets is also given.

2. Coding System

2.1. **Behavioural Code:**

This coding system which follows aims to identify as many as possible of the elementary behaviours without making assumptions as to their functions. As such, it is the first phase of description, and the most detailed.

i) ARMS AND HANDS (A):

- Hands in the mouth (m): The infant moves the hand (or both hands) and puts it (or them) in the mouth.
- Hands joined (j): The infant moves both hands and puts them together, each palm touching the other.
- Hold cushion (c): The infant grasps the pillow inside the push-chair.
- Hold ear (e): The infant moves the hand and holds the ear.
- Hold feet and/or legs (f): The infant moves the feet or legs up and holds them (or holds a foot).
- Hold garments (g): The infant holds a part of the clothes.
- Hold head (h): The infant moves the hands up and holds the head.
- Hold straps/anything (s): The infant holds the straps or any other part of the push-chair.
- Move down (d): The infant moves the hands down.
- Move left (l): The infant moves the hands to the left.
- Move right (r): The infant moves the hands to the right.
- Move up (u): The infant moves the hands up.
- Open arms (o): The infant opens the arms.
- Pull up clothes (p): The infant holds the clothes and pulls them up.



- Touch face (t): The infant moves hands up and either touches the face, or scratches it.

ii) BODY (B):

- Down (d): The infant moves the body as if to 'hide' in the push-chair.
- Escape (e): The infant moves up and forward, pushing, with the help of the legs and hands, to escape from the push-chair.
- Forward (f): The infant slides the body to the front of the push-chair.
- Incline (i): The infant pushes against the back of the push-chair.
- Left (l): The infant moves the body to the left side of the push-chair.
- Right (r): The infant moves the body to the right side of the push-chair.
- Up: The infant moves the body up.

In the Mirror Study, the following behaviours were coded under BODY (B):

- Crawl (c); The infant crawls.
- Stand up (s): The infant stands up and touches the mirror.
- Bend (b): The infant bends the body to touch something on the floor.

iii) EXPRESSION (X):

- Close eyes (e): The infant closes the eyes.
- Cough (c): The infant coughs.
- Funny pout (f): The infant makes a pout expression with the mouth, looking at the other infant and smiling.
- Grimace (g): The infant makes a contorted facial expression, anticipating a cry.
- Kisses (k): The infant sends kisses to the other infant.

- Laugh (l): The infant gazes at the other infant and laughs.
- Open eyes (o): The infant opens eyes wide.
- Pout (p): The infant makes a pout expression with the mouth, normally anticipating a cry.
- Relax (r): The infant stops crying.
- Smile (s): The infant gazes at the other infant and smiles.
- Tongue protruding (t): The infant projects the tongue.
- Weep (w): The infant cries.
- Yawn (y): The infant yawns.
- Zero expression (z): The infant gazes at the other infant's face and keeps a still-face for more than 2 seconds.

In the Mirror Study, the following behaviour was coded under EXPRESSION (X):

- Hide (d): The infant hides behind clothes or toys in the pram.

iv) EYES (E):

- Gaze (g): The infant gazes at the other infant's eyes, face or body.
- Look at feet (f): The infant gazes to the own feet.
- Look at mum (m): The infant gazes to the position where the mother is seated.
- Look at own hands (h): The infant gazes to the own hands.
- Look backwards (b): The infant gazes to the back of the push-chair, turning the body to the back.
- Look at clothes (c): The infant gazes to own clothes, holding part of them.
- Look down (d): The infant gazes down.

- Look left (l): The infant gazes left.
- Look right (r): The infant gazes right.
- Look up (u): The infant gazes up.

v) GESTURE (G):

- Any move (a): The infant moves the hand in any direction (up, down, right, or left).
- Clap hands (c): The infant claps hands.
- Point (p): The infant points to the other infant's direction.
- Wave (w): The infant makes a waving movement with the hands, directed to the other infant.

In the Mirror Study, the following behaviours were coded under GESTURE (G):

- Socks (s): The infant takes the socks off.
- Touch (t): The infant touches the mirror with hands or head.
- Bang (k): The infant bangs the mirror with hands or cup.
- Lamp (b): The infant touches the lamp on the side of the mirror box.
- Lick (l): The infant licks the mirror.

vi) HEAD (H):

- Move down (d): The infant moves the head down.
- Move left (l): The infant moves the head to the left.
- Move right (r): The infant moves the head to the right.
- Move up (u): The infant moves the head up.

vii) LEGS AND FEET (L):

- Jump (j): The infant jumps up and down, either on the push-chair or on the floor.
- Kick(k): The infant kicks against the push-chair.
- Move down (d): The infant moves legs and feet down.
- Move left (l): The infant moves legs and feet left.
- Move right (r): The infant moves legs and feet right.
- Move up (u): The infant moves legs and feet up.
- Move up and down (m): The infant moves legs and feet up and then down, in a continuous movement.
- Open legs (o): The infant open both legs wide.
- Put foot in the mouth (f): The infant moves the foot up and puts it in the mouth.
- Put together (t): The infant moves both feet and places them with their soles together.
- Swing (s): The infant moves feet and legs first to the right, and then to the left (or, vice-versa), and back again, in a rhythmic movement.

viii) MOUTH (M):

- Chew dress (d): The infant puts the clothes in the mouth and chews them.
- Chew straps (s): The infant puts the push-chair straps in the mouth and chews them.
- Close mouth (m): The infant closes the mouth.
- Open mouth (o): The infant opens the mouth.

In the Mirror Study, the following behaviours were recorded under MOUTH (M):

- Chew (c): The infant makes mouth movements, pretending to chew.
- Pillow (p): The infant chews the pillow.
- Spit (w): The infant spits.
- Tongue (h): The infant touches and holds the tongue.

ix) TOYS (T): This is a special category, which appeared only in very few situations. Nevertheless, as the presence of toys seems to lead to a different kind of interaction, we decided to include this category for a better observation of those interactions where toys play a part.

Investigatory	Presentations
Chew (c)	Offer (p)
Drop (d)	Tease (t)
Hold (h)	
Look at (l)	
Manipulate (m)	
Shake/Bang (s)	

x) VOCALISATIONS (V):

- Attention (a): the first infant starts the interaction with a vocalisation aimed to call the other infant's attention.
- Change (c): vocalisations started as Self-centred ones, but changed to vocalisations of Attention .
- Determined (d): a strong appeal to gain the other's attention.
- Fussy (f): vocalisation that shows any kind of distress or tiredness of the infant, normally ending with cry.

- Reply (r): any of an infant's answer to the other's request through a vocalisation, which immediately follows the other's request.
- Self-centred (s): vocalisations the infant produces for himself, not aimed at the other infant.

In the Mirror Study, the following VOCALISATIONS (V) were recorded:

- Boo (b): The infant vocalises "boo" to cause surprise.
- Click (c): The infant makes a "click" sound with the tongue.
- Scream (n): The infant screams, but this is a happy, playful sound.

2.2. Intersubjective Functional Code:

The aim of this categorisation, as its name suggests, is to identify psychological and interpersonal functions; that is, to permit the grouping of infants' acts in a more dynamic and interactive perspective, identifying their purpose, rather than making a simple description of behaviours.

However, the functions were defined on the basis of the Behavioural Categories, by combining them in functional groups, and many of the definitions are the same.

i) OBSERVANT (OB): Infant 1 either regards directly Infant 2, in a straight line, eye-to-eye, or looks from the corner of the eye, but into the other Infant's direction. This function includes the following Behavioural Codes: gaze (g) and zero expression (z), from the EYES (E) category.

ii) WITHDRAWAL (WI): coded whenever the Infant does not communicate, directing the attention to other things, such as the push-chair straps, mother, or closing eyes, and so on. The following Behavioural Codes can be included here: look at feet (f), look at mum (m), look backwards (b), look down (d), look clothes (c), look left (l), look own hands (h), look right (r), look up (u), from EYES (E) category; close eyes (c), from EXPRESSION (X) category; look (l) from the TOYS (T) category. Boredom may be a sign of withdrawal; an example of this category is yawning (y), from the EXPRESSION (X) category.

iii) IRRITATED (IR): coded when an infant attempts to bite, hit or kick the other one; also, when they cry, or make pouting faces or grimaces. Behaviours from the Behavioural Codes that fit this category are: weep (w), grimace (g), pout (p), from the EXPRESSION (X) category.

iv) FRIENDLY (FR): when any of the Infants look at the other, smiling or laughing, with or without vocalisations. Behaviour Codes that may be included in this category: cough (c), funny pout (f), kisses (k), laugh (l), open eyes (o), smile (s), tongue protruding (t), from the EXPRESSION (X) category; kick (k) from the LEGS AND FEET category (L); point (p), wave (w), from the GESTURE (G) category; offer (o), tease (t), from the TOYS (T) category.

v) VOCALISATIONS (VO): This category includes all the behaviours coded as Vocalisations in the Behavioural Code. All vocalisations

(attention; change; determined; fussy; reply; self-centred) are coded as VO here.

vi) BODY EXPRESSIONS (BE): like holding feet, put feet in the mouth, hands in the mouth, moving body to the left or to the right, moving hands to the left or to the right. The behaviours that form this category are all the ones from the ARMS AND HANDS (A); BODY (B); HEAD (H); MOUTH (M); LEGS AND FEET (L); and chew (c); drop (d); hold (h); manipulate (m), and shake/bang (s), from the TOYS (T) category, of the Behavioural Code.

2.3. Negotiatory Code:

After making the *Intersubjective Functional Code*, it was clear that a broader grouping was needed, that would facilitate the analysis of motives for interaction.

As a result, four new categories were created in what was called the *Negotiatory Code*, because it shows the infants negotiating their interaction.

i) INTERACTION: both infants are involved in some kind of interactions, normally beginning with a look at the other's direction (OB), followed by vocalisations (VO), smiles(FR), laughs (FR), pointing at (FR), waving (FR), looking at each other (OB), and keeping gaze fixed on one another (OB).

ii) INVITATION: one of the two infants tries to make contact but is not successful, that is, the other infant does not answer. This may or may not lead to a new interaction. It has the potential to create new interactions. The infant who seeks invitation looks at the other (OB) and this behaviour is followed by others, such as the ones explained above (INTERACTION). But the other infant just gazes back (OB), without any other reaction.

iii) LOOK: both infants gaze at each other (OB), but no other behaviour follows. Although all categories start with a gaze, this one is specific, because nothing more happens (not even a negative situation).

iv) IMITATION: one infant a) reproduces the other's behaviours, b) tries to reproduce the other's behaviour, but is only partially successful; c) both infants behave the same way at the same time (attunement - Stern, 1985).

2.4. Emotional Code:

One objective of this thesis is to understand the process of emotional interaction between infants, so an *Emotional Code* was needed.

As with the preceding coding systems, the *Emotional Code* was a result of re-grouping the elements of the Behavioural Code. The observed emotional categories distinguished are:

Positive emotional:

Curiosity (CU+)

Friendliness (FR+)

Negative emotional:

Indifference (IN-)

Irritation (IR-)

i) CURIOSITY: this category depends entirely on gaze (coded as OB in the Intersubjective Functional Code). This way, all OB behaviours are coded as OB: CU+, except those defined as "still face", which are coded as OB: IN- .

ii) FRIENDLINESS: this category is based in behaviours previously coded as FR in the Intersubjective Functional Code. VO are coded as VO: FR+ in the case of Va (Attention), Vr (Reply), Vd (Determined). BE is a consequence of what happens first (if the previous behaviours are positive, then BE is coded BE: FR+). FR: IN- is coded when a FR behaviour follows a WI (Withdrawal) behaviour.

iii) INDIFFERENCE: this category is firstly defined by WI, which means that the infant stops gazing at the other and looks in another direction.

Therefore, this can include other behaviours, as a result, such as BE. Also, VO is coded as VO: IN- in the case of Vs (Self-centred).

iv) IRRITATION: this category is based in behaviours previously coded as IR in the Intersubjective Functional Code. BE is a consequence, as much as WI. VO is coded as VO: IR- in the case of Vf (Fussy).

In relation to BE, in the case of positive emotions, when the behaviour starts as OB: CU+, then the following BE will be coded as BE: FR+. The same happens for FR: FR+. In the case of negative emotions, when the first behaviour starts as WI: IN-, then the following BE is coded as BE: IN-; if it starts as WI: IR- or IR: IR-, then the following BE is coded as BE: IR-.

As a summary when the emotional categories above are combined with the *Intersubjective Functional Code*, the observed categories are:

In the positive side:

BE: FR+ FR: FR+ OB: CU+ VO: FR+

In the negative side:

BE: IN- BE: IR- FR: IN- FR: IR- IR: IR-
OB: CU- VO: IN- VO: IR- WI: IN- WI: IR-

In conclusion, the above coding system comprised four parts.

The first *Behavioural Code* simply notes distinguishable behaviours descriptively without identifying their functions. This coding system was suitable for a microanalytical account.

The second is an *Intersubjective Functional Code* which attempts to identify functions for all the behaviours previously categorised, including their emotional tones, and group them functionally.

The third system, called a *Negotiatory Code*, was formed by collapsing the previous code into broader categories to identify interactive or communicative functions.

The fourth system, the *Emotional Code* covered the emotions presented and related them to the Intersubjective Functional code.

Thus the procedure was to identify all behaviours first, and afterwards recategorize them using the *Intersubjective Functional* code. Emotions were, then, coded according to the *Emotional* code and, at last, the *Negotiatory* code was applied.

2.5. The Mirror Study:

When the videos with the mirror recordings were viewed, it was clear that a new code for both interactive and emotional functions, was needed to interpret the behaviours shown.

A different interactive code was needed because in the mirror, a different set of behaviours were displayed, to be described as Interaction (with own image) and Distraction. Imitation was not coded, because in the mirror situation behaviours are necessarily the same in subject and mirror image.

A new emotional code was also needed because the infants showed different emotions from those coded in the Cross-Sectional and Longitudinal studies.

Thus, the codes for the mirror are:

i) MIRROR INTERACTIVE CODE: this code is basically the same for the Cross-Sectional Study, and it was divided into:

- Communication: every time the infant looked at the mirror and either pointed, smiled, vocalised, touched the mirror, looked down at parts of the body reflected in the mirror.
- Distraction/Avoidance: the infant gave attention elsewhere: looked back, or to the right or left, or looked to the mum.

ii) MIRROR EMOTIONAL CODE: it was divided into the following categories:

- Attentive: the infant gazed at the image and maintained gaze for more than 2 seconds, opening the mouth, or closing it, or made a movement towards the mirror, still looking.
- Friendly: the infant, gazing at the image, then smiled or laughed, pointed, waved, kicked, touched the mirror or licked it.
- Happy: the infant smiled or laughed, looking at the image, or to the mum⁴.
- Irritated: the infant tried to escape from the push-chair, or started to be fussy or crying.
- Self-exploratory: the infant looked to the mirror, moving part of the body, then, stopped the movement and looked to the part of the body that he or she had moved, moved it again, then looked back to the

⁴The difference between Happy and Friendly is that in Friendly, besides the smiling face, the infant showed behaviours towards the mirror.

mirror, still moving that part of the body. This is clearly not a pure emotional category, but the infant showed a surprised expression, which made it appear in part, emotional.

- Shy: the infant looked to the mirror and tried to cover the face with parts of the body or with toys or pieces of cloth. Another sign was when the infant smiled faintly and looked down and to the mirror and down again, lifting the head very slowly and looking back to the mirror.

- Surprised: the infant opened the eyes very wide, raised eyebrows, and also opened the mouth, while looking at the mirror.

- Unsettled: the infant start to move from one side to the other, or up and down, frowning or grimacing.

The procedure in the Mirror Study was the same as for the Cross-Sectional and Longitudinal studies. First, all behaviours were identified, and afterwards they were recategorized using the *Mirror Interactive Code*. Then, emotions were identified according to the *Mirror Emotional Code*.

Chapter IV

RESULTS

Data from the three studies, Cross-Sectional, Longitudinal, and Mirror were analysed as follows.

In the Cross-Sectional and Longitudinal studies, behaviours were categorised according to:

1. A Negotiatory Code; in which group differences were assessed in the following functions of behaviour:
 - a) Interaction; b) Invitation; c) Imitation.
2. An Emotional Code, comprising the following categories:
 - a) Positive Emotions: Curiosity and Friendliness;
 - b) Negative Emotions: Indifference and Irritation.

In the Mirror study, modified codes were used in recognition of the artificial intersubjective situation:

1. An Interactive Code, with the following categories:
 - a) Communicative; b) Distracted/Avoidant.
2. An Emotional Code, identifying the following categories:
 - a) Attentive; b) Friendly; c) Happy; d) Irritated;
 - e) Self-exploratory; f) Shy; g) Surprised; h) Unsettled.

Because the number of subjects in the Mirror Study is different in each Age Group, these groups were analysed separately.

Gender related effects were examined in all 3 studies.

1. CROSS-SECTIONAL STUDY

1.1. NEGOTIATION: INDIVIDUAL BEHAVIOURS

Data are reported for 3 different triads of infants, at different ages, each triad comprising one girl interacting separately with two boys.

As has been explained in Chapter II, first a detailed description of each infant's behaviours was made, then behaviours were grouped in categories, and finally, the latter were collapsed into 4 broad behaviour types, Interacting, Inviting, Looking, and Imitating. Looking was excluded from analysis, as the other types of behaviour required mutual gaze to be maintained. This code of behavioural types, intended to give information on the presence and type of any intersubjective responses, was called 'Negotiatory'.

In the following tables, numbers represent the incidence of the named behaviours in a sample of 3 minutes. Numbers in italics represent percentages of behaviours.

1.1.1. Negotiation by Age Groups

The following table (Table IV.1) shows the frequency of behaviours in each category of the Negotiatory Code, for the three age groups.

	6 Months			8 Months			9 Months					
	Ellen	Andrew	David	Total	Holly	Monty	Thomas	Total	Emily	Adam	Stuart	Total
Imitation	9	3	7	19	18	14	2	34	29	14	19	62
Interaction	7	4	3	14	20	17	3	40	31	18	27	76
Invitation	23	9	7	39	7	8	1	16	30	25	3	58
Total	39	16	17	72	45	39	6	90	90	57	49	196
	54	22	24	100	50	43	7	100	46	29	25	100

Table IV. 1: Cross-Sectional Study; Negotiatory Code.

Chart IV.1 shows a clear picture of the three different ages. A general increase in communication is shown, with an apparent drop in the frequency of invitations at 8 months.

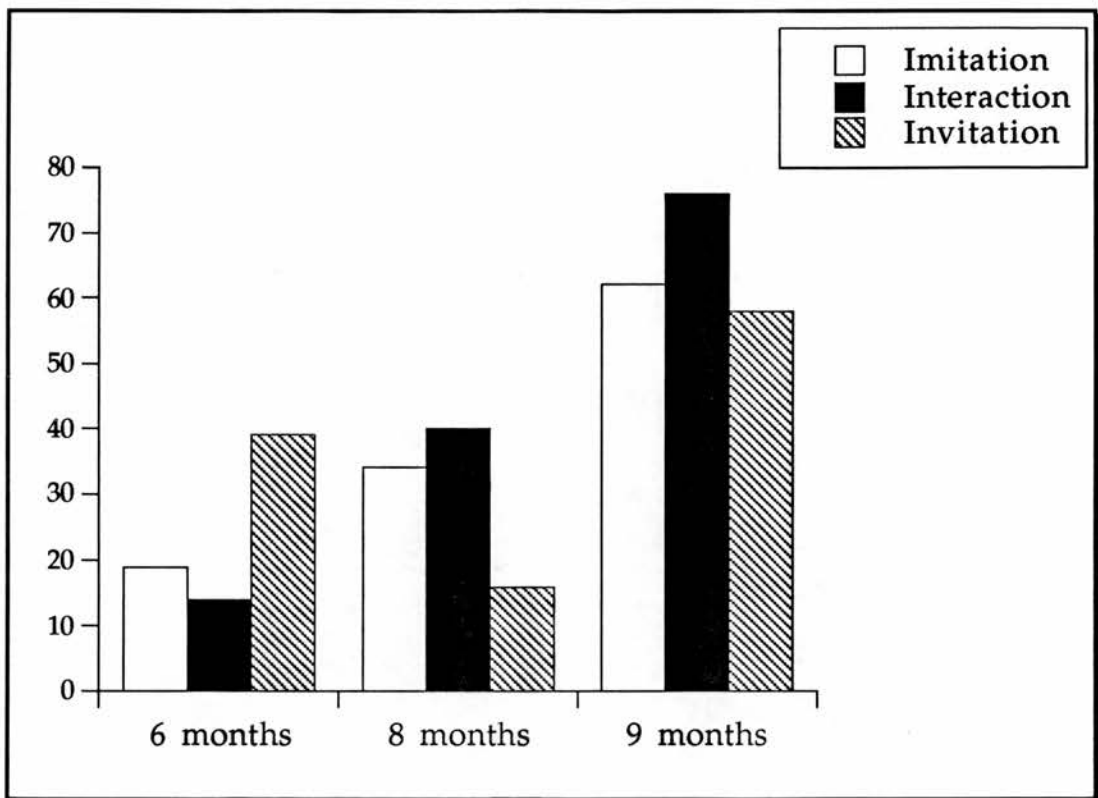


Chart IV.1: Cross-Sectional Study; Negotiatory Code; Differences by Age.

At 6 months, the highest percentage of behaviours is in the Invitation category (54.2%), which indicates that the infants were trying to interact with each other, and that they were not always successful. Invitation included attempts at eliciting a reaction, and they could fail.

At 8 months, Interactions and Imitations are approximately equal, and Invitations have dropped by half. This may indicate an eagerness to interact continuously, with little time left for pauses that might prompt invitations.

At 9 months, there is more communicative ability and all the three categories are equally frequent, which indicates that infants are vigorously involved in interactions, using imitations and inviting each other for new interactions.

A chi-square test and a likelihood ratio show highly significant differences across the three ages, for all three categories, suggesting that the above data indicate a real evolution of interactive patterns.

	Value	DF	Significance
Pearson χ^2	49.091	16	.00003
Likelihood Ratio	53.185	16	.00001

1.1.2. Negotiation by Gender⁵:

At each age, the behaviours of the 2 boys indicate a lower level of motivation for communication, than the girl. At 9 months, boys are slightly dominant over girls.

However, chi-square tests showed that those differences could not be taken as significant. And, as the number of boys and girls is different, the results are not fair for the girls. The only possibility would be to test each girl against each boy (in each age group). The result showed no significant difference between boys and girls, except in one case (Emily X Stuart, 9 months; $\chi^2= 13.53$, $df= 2$, $p < 0.001$). In this case, that result favours the girl.

Chart IV.1.1 shows the behaviours of all 9 subjects:

⁵Please, see Table IV.1.

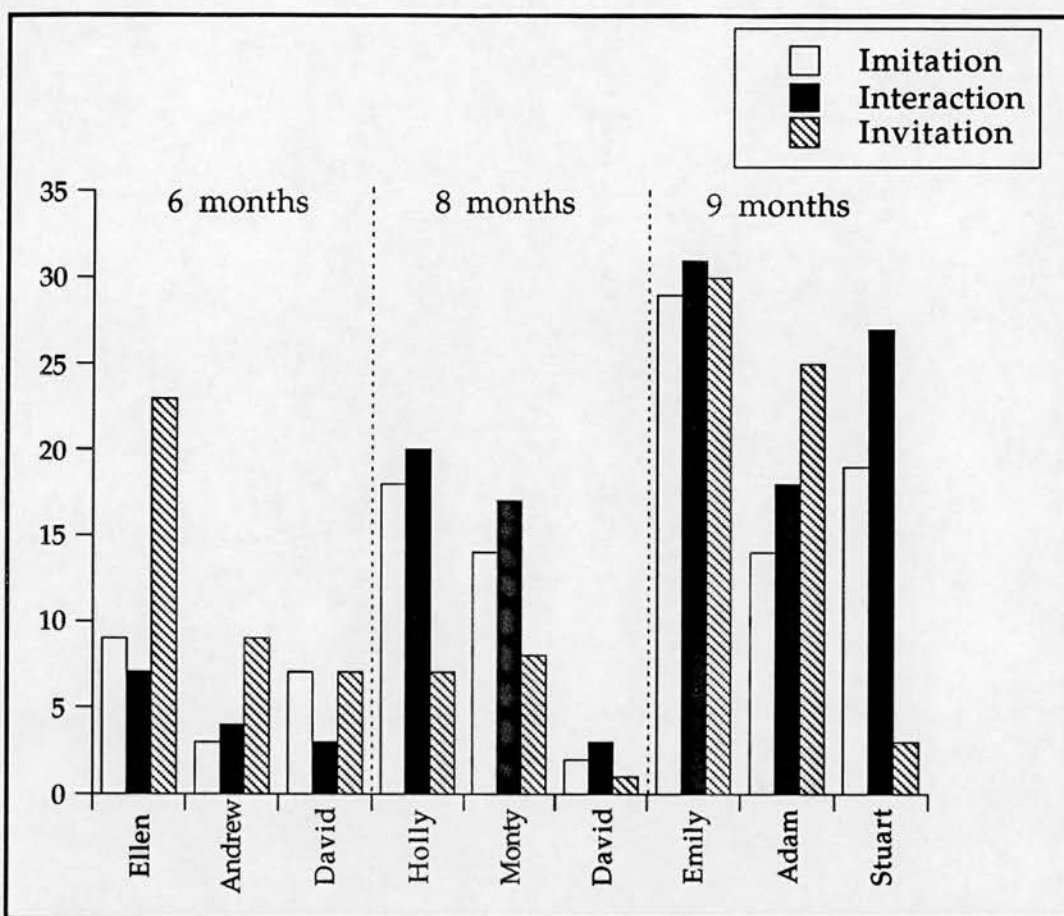


Chart IV.1.1: Cross-Sectional Study; Negotiatory Code; Differences by Gender, showing all subjects.

1.1.3. Negotiation by Infant Dyad:

At each age there were three dyads; two girl-boy and one boy-boy.

Table IV.2 shows the frequency of behaviours in each pair.

The most notable result is that at 6 and 8 months, no interactions were found when boys were paired. Only in the third age group did the two boys show interactive patterns when faced with each other, but, still in lower percentages than when these boys were interacting with the girl Emily.

6 Months

	Ellen + Andrew	Ellen + David	Andrew+ David	Total
Imitation	6	13	0	19
				27
Interaction	8	6	0	14
				19
Invitation	28	11	0	39
				54
Total	42	30	0	72
	58	42	0	100

8 Months

	Holly + Monty	Holly + Thomas	Monty + Thomas	Total
Imitation	28	6	0	34
				38
Interaction	34	6	0	40
				44
Invitation	12	4	0	16
				18
Total	74	16	0	90
	82	18	0	100

9 Months

	Emily + Adam	Emily + Stuart	Stuart + Adam	Total
Imitation	21	32	9	62
				32
Interaction	22	40	14	76
				39
Invitation	21	19	18	58
				29
Total	64	91	41	196
	33	46	21	100

Table IV.2: Cross-Sectional Study; Negotiatory Code; Infant Dyads.

This seems to support the hypothesis of a gender difference in the interactions between pairs of infants. Girl-boy pairs show much more interactions at all ages (despite the differences being non-significant at 8 months). Girls were not recorded interacting with girls in this study.

A loglinear analysis was conducted to search for the best model that could fit these data on interactions. The results showed that a model of interaction Gender+Age+Negotiatory code was the most appropriate. Statistical tests for this model show how significant it is:

Goodness-of-fit Statistics	Value	DF	Sig.
Pearson χ^2	32.168	12	.0013
Likelihood Ratio	30.891	12	.0020

These results mean that there is a significant interaction between gender, age and the interactive functions that are represented by the Negotiatory Code, that is, interactions change, both with the age of the infant and depending on his or her gender.

I conclude that, as infants develop, their interactive patterns change from an 'invitational' style, comprising attempts to interact, some successful, others not, to a more directed approach, with the help of imitations aimed to initiate interaction and to renew it, if it falters. Invitations in the older ages are almost always followed by an interaction. As far as gender is concerned, the results seem to indicate differences between boys and girls, although stronger evidence is needed.

Chart IV.2 demonstrates these results clearly:

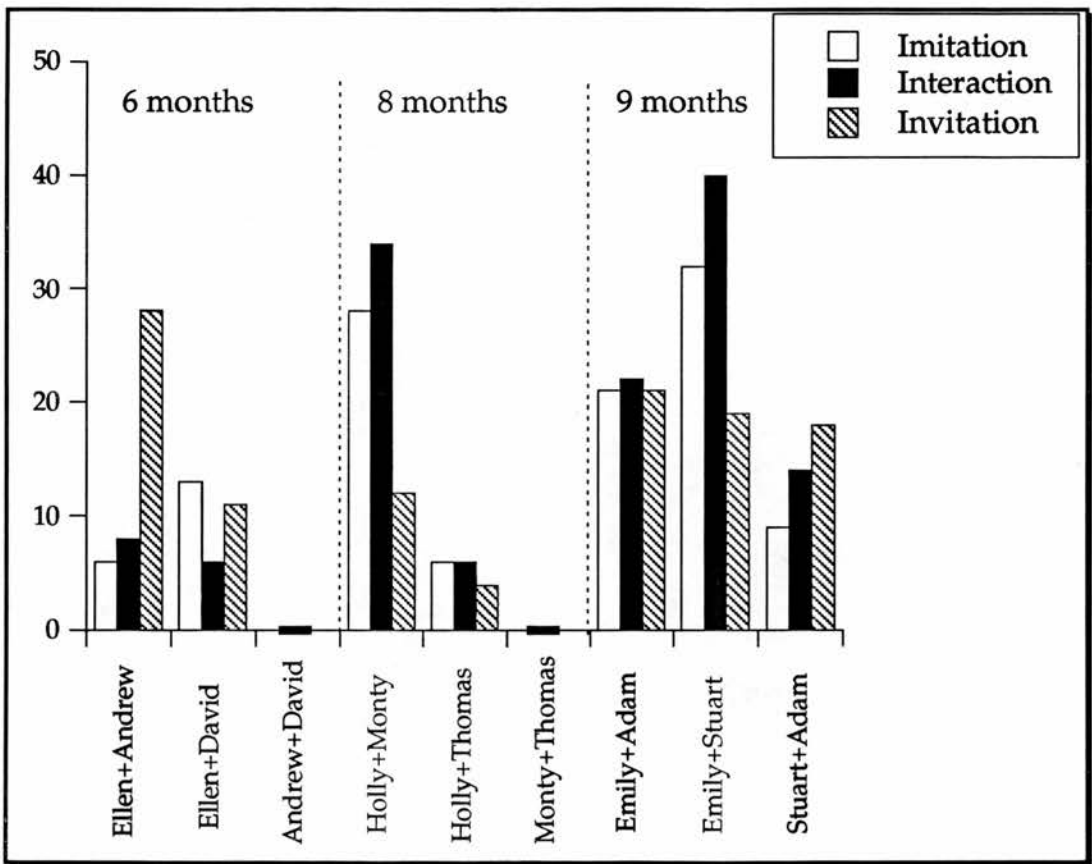


Chart IV.2: Cross-Sectional Study; Negotiatory Code; Gender Differences considering pairs of subjects, in the three age groups.

1.2. EMOTION: INDIVIDUAL BEHAVIOURS

Emotional behaviours showed by the subjects were coded in two categories: Negative and Positive. Positive emotions include Curiosity and Friendliness. Negative emotions are coded as Indifference and Irritation.

1.2.1. Emotions by Age Groups:

Table IV.3 appears to show that emotional behaviours change with age.

With the 9 infants seen, at 6 months, Curiosity (45%) prevails over Friendliness (26%) and Indifference (25%). Apparently, younger infants are curious about other infants, can react in a friendly way to them, but equally can be disinterested, or may shift their attention to other things in the environment.

At 8 months, the infants recorded here, were curious (50%), but they were also more friendlier (35%) than indifferent (15%). They appeared more able to keep their attention to the other infant for longer periods.

The infants, at 9 months, show Curiosity (39%) and Friendliness (35%) in equal measures. Evidently, those infants were more able to change from the initial interest aroused by confronting another being like themselves, and to show positive emotions toward the other infant. The Indifference score (25%) shows that they are able to ignore the other infant from time to time. It seems that the infants' emotions at 9 months are not so polarised as before.

	6 Months				8 Months				9 Months			
	Ellen	Andrew	David	Total	Holly	Monty	Thomas	Total	Emily	Adam	Stuart	Total
Curiosity	47	43	11	101 45	40	30	8	78 50	68	47	42	157 39
Friendliness	35	12	10	57 26	26	25	4	55 35	62	46	35	143 35
Indifference	31	13	12	56 25	12	12	0	24 15	19	37	44	100 25
Irritation	4	4	0	8 4	0	0	0	0 0	1	5	0	6 1
Total	117 53	72 32	33 15	222 100	78 49.7	67 42.7	12 7.6	157 100	150 37	135 33	121 30	406 100

Table IV. 3: Cross-Sectional Study; Emotional Code; All Subjects

It is noticeable that there was very little Irritation, at all three ages. I considered dropping this category for statistical analysis (the presence of many zeros is not good for loglinear tests), but, as it is an interesting result, I decided to keep it in.

Chart IV.3 presents these results:

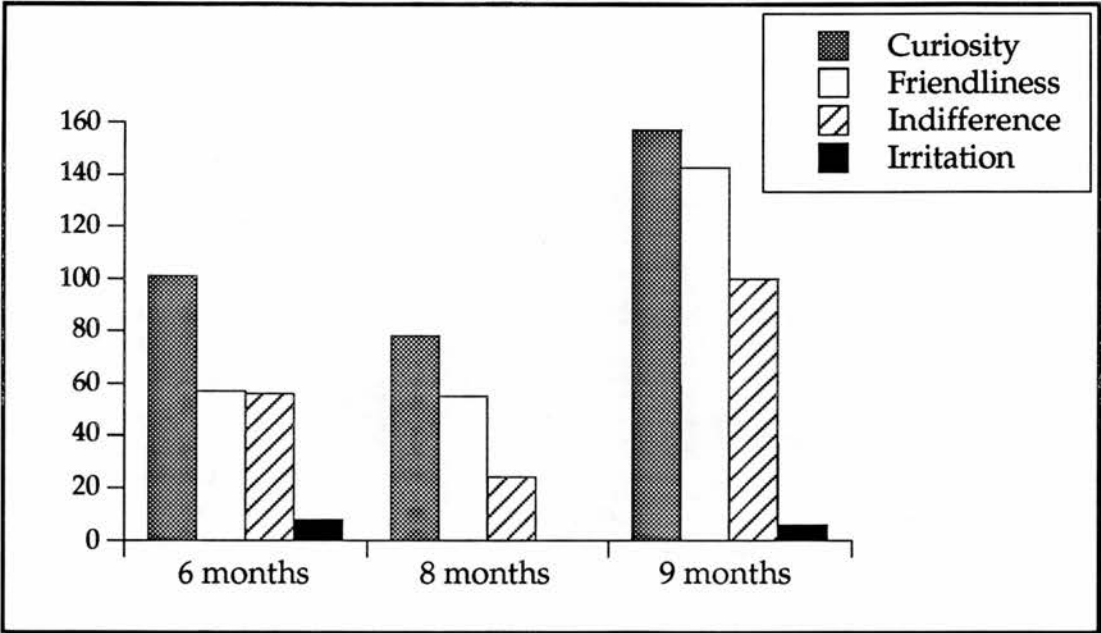


Chart IV.3: Cross-Sectional Study; Emotional Code; Differences by Age.

1.2.2. Emotions by Gender ⁶:

A Chart showing all subjects, displays the results for gender:

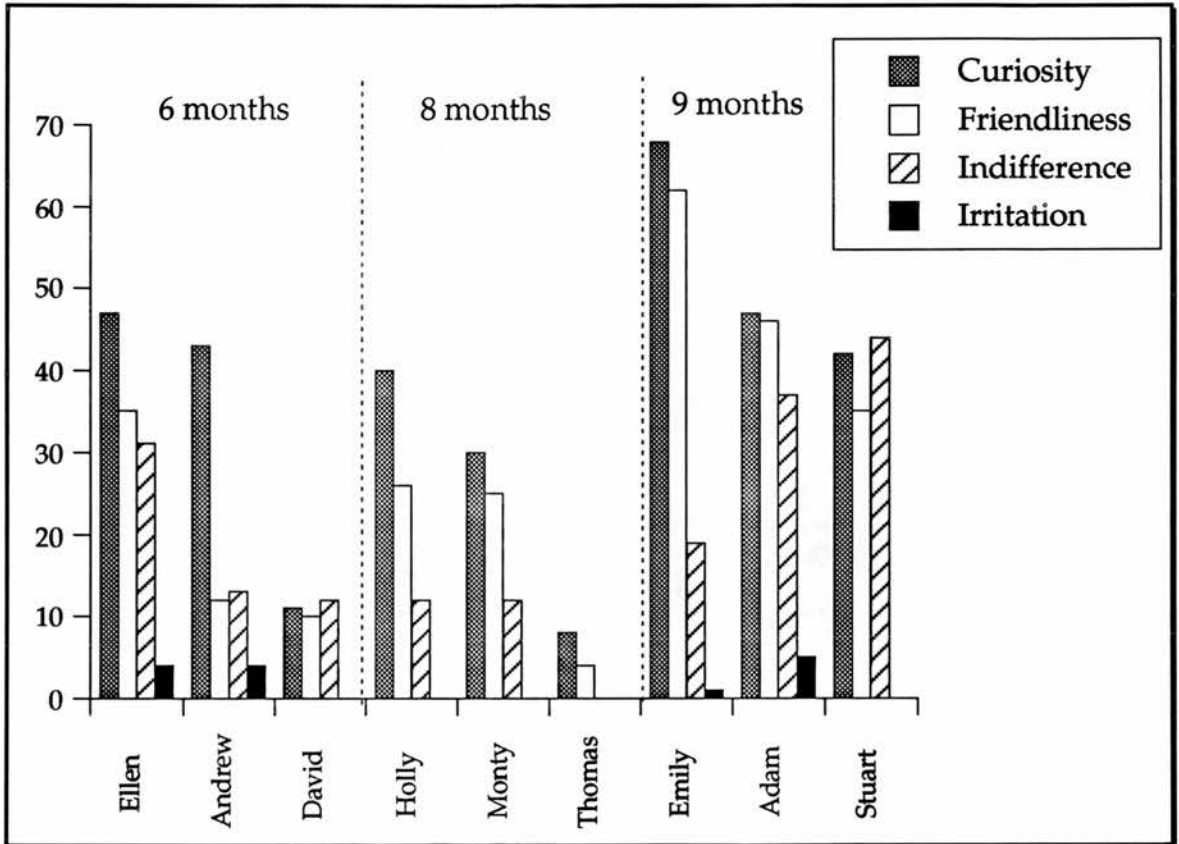


Chart IV.3.1: Cross-Sectional Study; Emotional Code; All Subjects.

⁶ Please, see Table IV.3 for data of all subjects.

1.2.3. Emotions by Infant Dyad:

Table IV.4 shows the frequency of behaviours in each pair.

The most important thing to be observed in this table is that there are no emotional exchanges between boys at 6 and 8 months. Chart IV.4 shows these differences clearly:

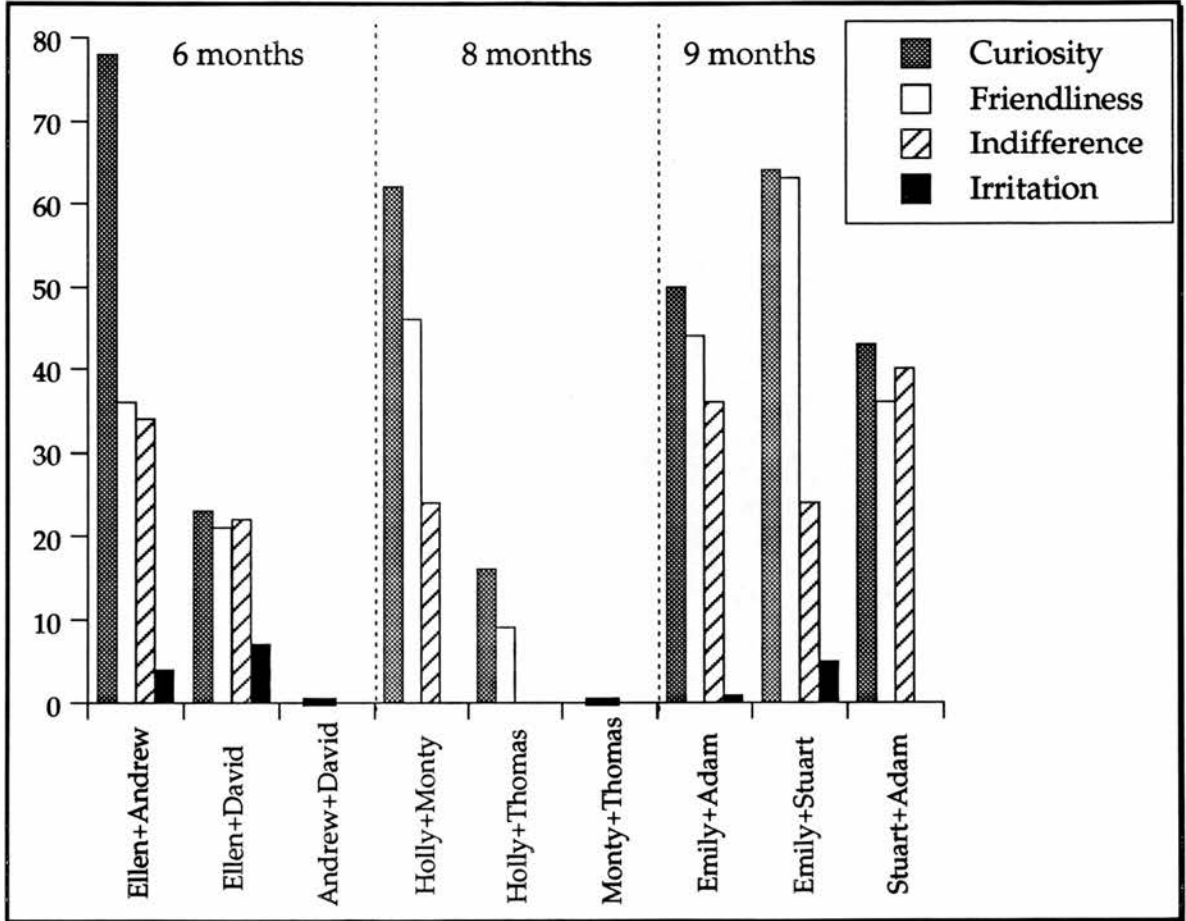


Chart IV.4: Cross-Sectional Study; Emotional Code; Gender Differences considering pairs of subjects, in the three age groups.

	6 months				8 months				9 months			
	Ellen + Andrew	Ellen + David	Andrew + David	Total	Holly + Monty	Holly + Thomas	Monty + Thomas	Total	Emily + Adam	Emily + Stuart	Stuart + Adam	Total
Curiosity	78	23	0	101	62	16	0	78	50	64	43	157
Friendliness	36	21	0	57	46	9	0	55	44	63	36	143
Indifference	34	22	0	56	24	0	0	24	36	24	40	100
Irritation	4	7	0	11	0	0	0	0	1	5	0	6
Total	155	67	0	222	132	25	0	157	130	152	124	406
	70	30	0	100	84	16	0	100	32	37	31	100

Table IV.4: Cross-Sectional Study; Emotional Code; Infants' Dyads

A loglinear analysis was conducted to search for the best model that could fit these emotional situations. The best fitting model seems to be the one that considers the interaction among Gender+Age+Emotional situations (expressed by the Emotional Code). In fact, the statistical tests show a very high degree of significance for that model:

Goodness-of-fit Statistics	Value	DF	Sig.
Pearson χ^2	60.837	17	.0000008
Likelihood Ratio	65.312	17	.0000001

According to this model, an infant's emotion is related to both gender and age. Girls seem to express their emotions more than boys, who tend not to interact emotionally with other boys, at least in younger ages (6 and 8 months). It seems that at first, Curiosity leads the expressions when interacting with others, with Indifference and Friendliness showing the same rate of occurrence. But, as infants become older, friendly expressions appear to take precedence over other expressions, and, by 9 months, a more balanced pattern of emotional expressions is achieved, concerning the interaction with other infants. Active negative emotions, such as Irritation appear in a very low number, meaning that probably the first emotional interactions with others are very positive toned.

2. LONGITUDINAL STUDY

2.1. NEGOTIATION: INDIVIDUAL BEHAVIOURS

As mentioned in Chapter IV - Methods, four subjects were included in the Longitudinal study, two girls and two boys (one girl and two boys were also part of the Cross-Sectional study, age group 1), recorded when they 20, 31 and 37 weeks-old.

2.1.1. Negotiation by Age Groups

Table IV.5 shows the results for all ages.

As in the Cross-Sectional study, at 6 months, the majority of behaviours fall into the Invitation category (52%). Interaction (20%) and Imitation (28%) are more or less balanced. As discussed before, this means that infants were trying to make contact with each other, but were not being successful in most of the situations.

At 8 and 9 months, there is a very balanced number of behaviours in the three categories, mainly at 8 months, when the proportions were more or less the same, with Interaction and Invitation with the same amount (33%) and Imitation with 34% of all behaviours. At 9 months, Invitation drops a little (29%) when compared with Interaction (32%), and Imitation (39%), but technically the frequencies are almost the same.

This is a different result from the Cross-Sectional study, because here there is no difference between 8 and 9 months. Such a result could (wrongly) lead us to conclude that from 8 to 9 months infants do not show any difference in interactive patterns. But it cannot be forgotten that, in the Cross-Sectional

	Ellen	Katie	Andrew	David	Totals
6 Months					
Imitation	11	1	3	7	22
					28
Interaction	8	1	4	3	16
					20
Invitation	25	0	9	7	41
					52
Totals	44	2	16	17	79
	56	2	20	21	100
8 Months					
Imitation	11	26	0	9	46
					34
Interaction	11	22	0	11	44
					33
Invitation	17	22	0	5	44
					33
Totals	39	70	0	25	134
	29	52	0	19	100
9 Months					
Imitation	21	13	5	0	39
					39
Interaction	16	8	8	0	32
					32
Invitation	15	12	2	0	29
					29
Totals	52	33	15	0	100
	52	33	15	0	100

Table IV.5: Longitudinal Study; Negotiatory Code; All Subjects.

study, they were familiar to each other after the first recordings. This familiarity could explain the same pattern of interactions at 8 and 9 months for this group.

A chart shows these results:

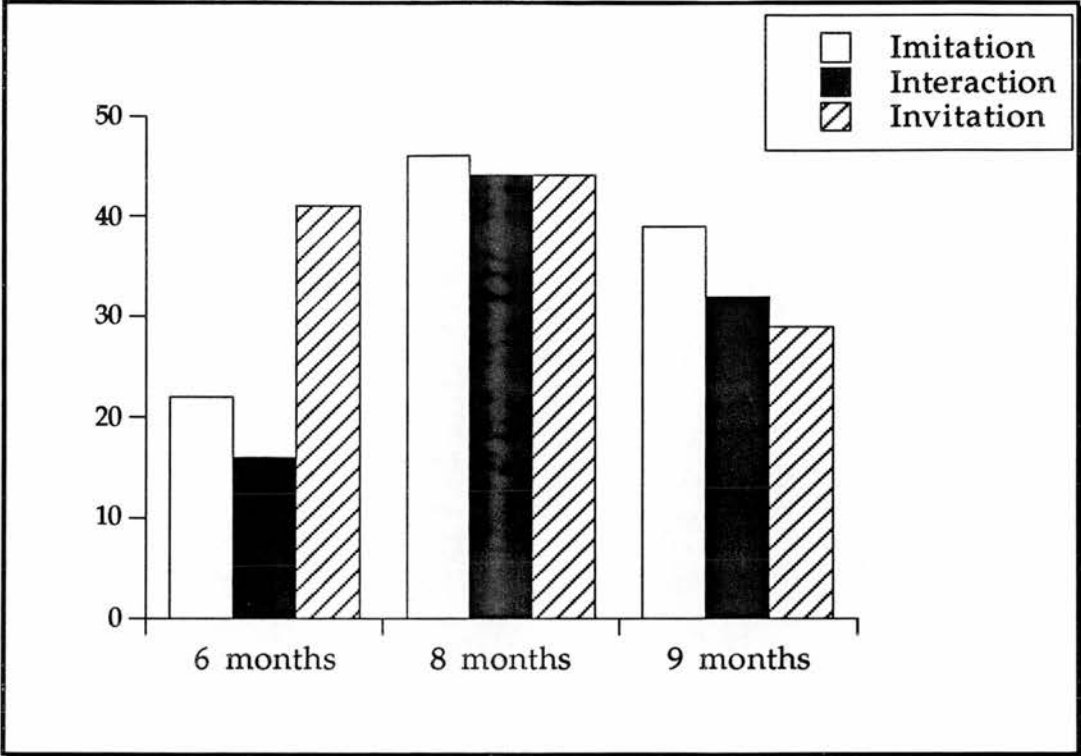


Chart IV.5: Longitudinal Study; Negotiatory Code; Differences by Age.

The results show that at 6 months, infants are able to get involved in interactions, although they are easily distracted by external factors. Consequently, they use more Invitations than older infants, in order to try to call the other infant's attention and to start a new interaction.

It is important to note that, as in the Cross-Sectional study, Imitations appear here in a significant number, in all three ages. Imitations are powerful means of interaction for infants, because they can use them to start a new

interaction, to keep the interaction going and to re-start it, once the other infant is distracted.⁷

2.1.2. Negotiation by Gender:

As table IV.6 shows, differences between boys and girls at 8 and 9 months are large. At 6 months the difference is less, although girls are still in advantage.

	6 Months			8 Months			9 Months		
	girls	boys	Total	girls	boys	Total	girls	boys	Total
Imitation	12	10	22	37	9	46	34	5	39
			28			34			39
Interaction	9	7	16	33	11	44	24	8	32
			20			33			32
Invitation	25	16	4	39	5	44	27	2	29
			52			33			29
Total	46	33	79	109	25	134	85	15	100
	58	42	100	81	19	100	85	15	100

Table IV.6: Longitudinal Study; Negotiatory Code; Gender Differences

These results are quite different from those of the Cross-Sectional study. The explanation is very simple: here, the number of boys and girls is the same, so the results show an actual picture of what is happening between boys and girls in interactive patterns.

Therefore, at 6 months, girls already show a difference in interactive patterns, when compared to boys at the same age. They not only interact and

⁷ This point will be developed on Chapter V - DISCUSSION

imitate more than the boys, but seem also to take more initiative in interactive situations, since they also invite more. Maybe this pattern changes in older children, but according to our data, girls are responsible for the majority of the interactive situations. This confirms the results for the Cross-Sectional study.

A Chart shows those results:

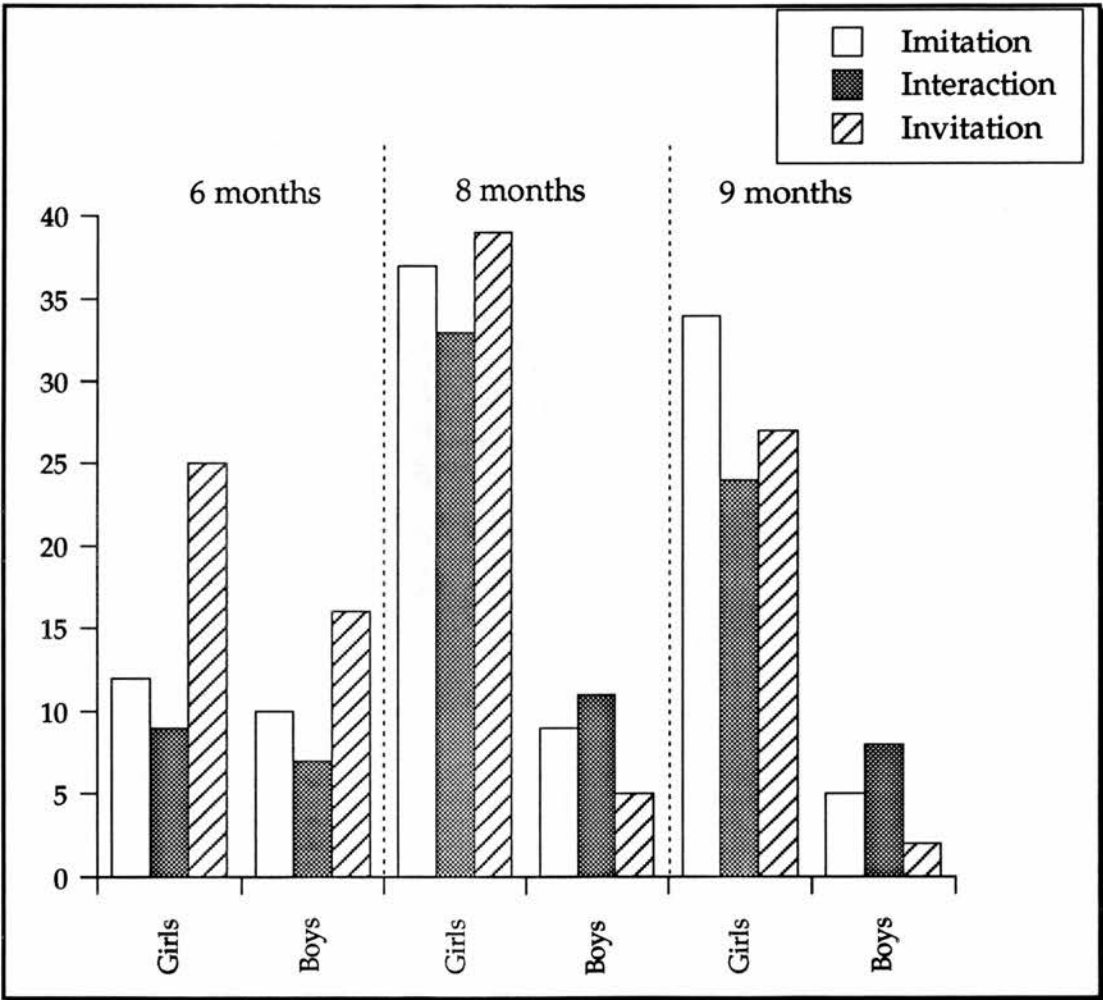


Chart IV.6: Longitudinal Study; Negotiatory Code; Differences by Gender.

2.1.3. Negotiation by Infants' Dyads:

Table IV.7 shows the results for pairs of infants, at all ages.

In all three age groups, there are no interactive exchanges between boys. This result is in accordance with the Cross-Sectional study, where only at 9 months, interactive exchanges between boys and boys were found.

The two girls interacted at all ages, and girls interacted with boys in 33% of the sessions.

At 6 months, interactive exchanges between boys and girls were the most numerous (more than 90% of the total behaviours). At 8 and 9 months only one of the four boy-girl pair interacted, and they did so slightly less than the two girls at these ages.

Chart IV.7 shows these results

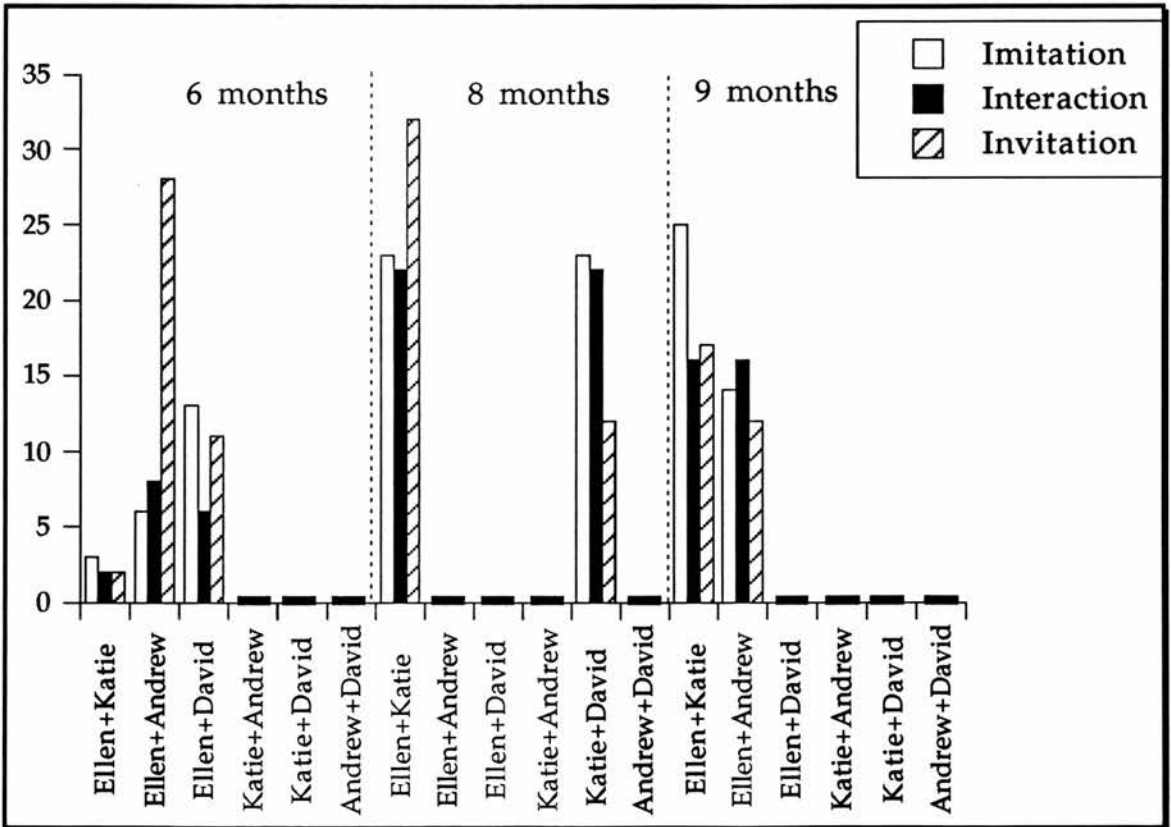


Chart IV.7: Longitudinal Study; Negotiatory Code; Gender Differences considering pairs of subjects, in the three age groups.

These results confirm that a difference of gender seems to exist in this sample, as far as interactive exchanges is concerned.

A loglinear analysis was conducted to find the best model that could fit these interactive exchanges. The results showed that a model of interaction between Gender + Age + Negotiatory Code was the best to be considered. Statistical tests for this model showed its high significance:

Goodness-of-fit Statistics	Value	DF	Sig.
Pearson χ^2	37.237	12	.0002
Likelihood Ratio	37.991	12	.0002

These results mean that there is a significant interaction between gender, age and the communication situations (represented by the Negotiatory Code), that is, communicative interactions change, depending on the age of the infant and on his or her gender. Also, the results for Negotiatory Code in the Longitudinal study confirm and support the results obtained in the Cross-Sectional study for Negotiatory Code.

	Ellen + Katie	Ellen + Andrew	Ellen + David	Katie + Andrew	Katie + David	Andrew + David	Totals
6 Months							
Imitation	3	6	13	0	0	0	22 28
Interaction	2	8	6	0	0	0	16 20
Invitation	2	28	11	0	0	0	41 52
Totals	7 9	42 53	30 38	0	0	0	79 100
8 Months							
Imitation	23	0	0	0	23	0	46 34
Interaction	22	0	0	0	22	0	44 33
Invitation	32	0	0	0	12	0	44 33
Totals	77 58	0 0	0 0	0 0	57 42	0 0	134 100
9 Months							
Imitation	25	14	0	0	0	0	39 39
Interaction	16	16	0	0	0	0	32 32
Invitation	17	12	0	0	0	0	29 29
Totals	58 58	42 42	0 0	0 0	0 0	0 0	100 100

Table IV.7: Longitudinal Study; Negotiatory Code; Infants' Dyads.

2.2. EMOTIONS: INDIVIDUAL BEHAVIOURS

Emotions were coded as Positive (Curiosity and Friendliness) and Negative (Indifference and Irritation), in the same way as in the Cross-Sectional study.

2.2.1. Emotions by Age Groups:

Table IV.8 shows many differences in emotional expressions according to different ages.

As in the Cross-Sectional study, Curiosity is the most prominent of the emotional expressions at 6 and 8 months (38% and 49%, respectively). At 8 months, the infants are predominantly curious and friendly. Between 8 and 9 months there is an increase in the proportion of Indifferent behaviour, which can be explained by the facility that the older infants have gained in shifting their attentions to other things and persons in their environment. This was not found in the Cross-Sectional study. The explanation resides in the fact that in this study, the infants were becoming used to each other and losing interest. Nevertheless, at the whole, the results show that infants tend to be curious about unfamiliar infants, and they react with friendly expressions to them. At 6 months, infants quickly get bored or disinterested, and react indifferently to the other infant. At 8 months, infants are less expressive, but ready to keep a friendly expression. However, at 9 months, if the other infant is already known, the infant will lose the interest and react with indifference. If the other is unfamiliar, then the emotional expressions will be more friendly and curious.

	Ellen	Katie	Andrew	David	Totals
6 Months					
Curiosity	75	29	43	11	158 39
Friendliness	67	30	12	10	119 29
Indifference	61	35	13	12	121 29
Irritation	0	0	4	8	12 3
Totals	211 51	94 23	72 18	33 8	410 100
8 Months					
Curiosity	5	23	0	19	47 49
Friendliness	3	19	0	15	37 38
Indifference	0	4	0	5	9 9
Irritation	0	3	0	1	4 4
Totals	8 8	49 51	0 0	40 41	97 100
9 Months					
Curiosity	5	23	16	0	84 32
Friendliness	28	23	10	0	61 23
Indifference	45	21	30	0	96 37
Irritation	14	5	2	0	21 8
Totals	132 50	72 28	58 22	0 0	262 100

Table IV.8: Longitudinal Study; Emotional Code; All Subjects.

Confirming the results of the Cross-Sectional study, infants showed very little expressions of Irritation. In fact, it seems that infants up to 9 months prefer

to use Indifference rather than Irritation to display a negative reaction to another infant.

Chart IV.8 shows these results:

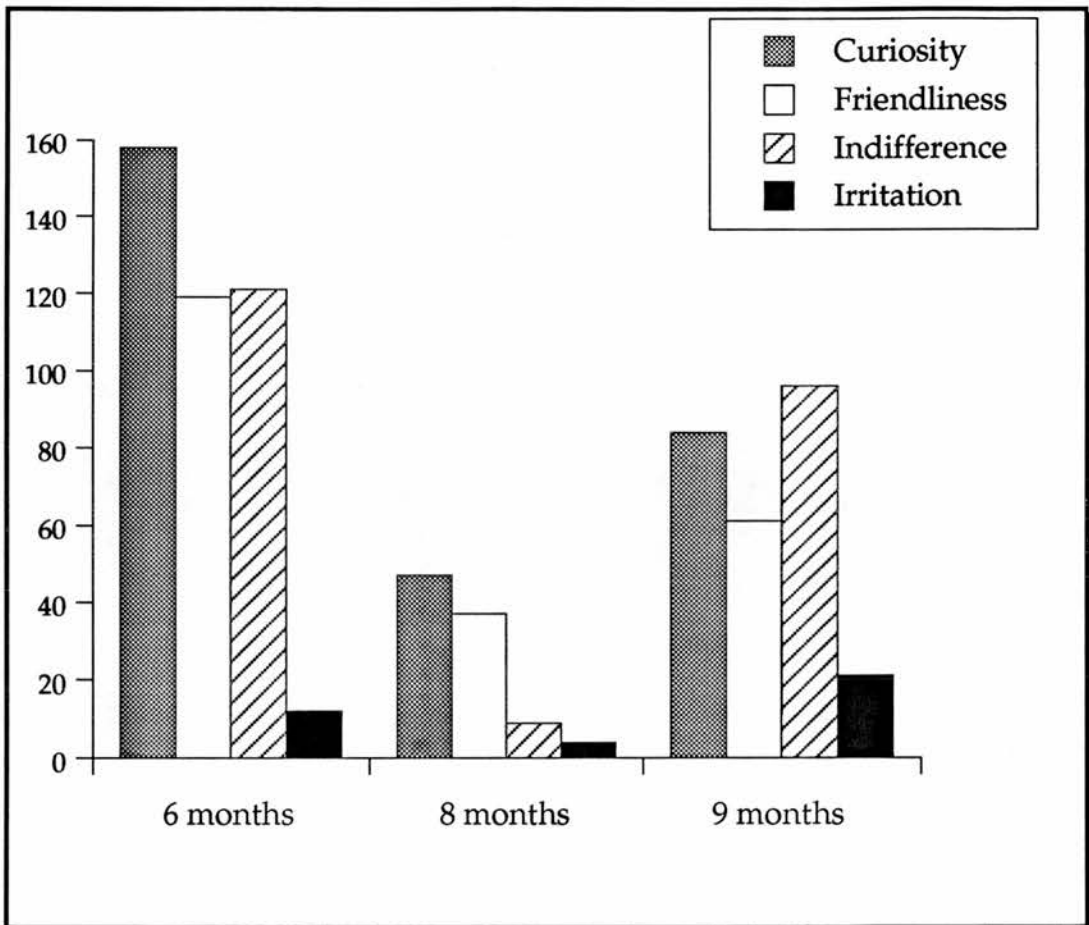


Chart IV.8: Longitudinal Study; Emotional Code; Differences by Age.

2.2.2. Emotions by Gender:

Table IV.9 shows a great difference in emotional expression between boys and girls, at all ages. Except in the case of 8 months, where the results are more equal, girls are almost four times more expressive than boys in their emotions.

	6 Months			8 Months			9 Months		
	girls	boys	Total	girls	boys	Total	girls	boys	Total
Curiosity	104	54	158	28	19	47	68	16	84
			39			49			32
Friendliness	97	22	119	22	15	37	51	10	61
			29			38			23
Indifference	96	25	121	4	5	9	66	30	96
			29			9			37
Irritation	0	12	12	3	1	4	19	2	21
			3			4			8
Total	305	105	410	57	40	97	204	58	262
	74	26	100	59	41	100	78	22	100

Table IV.9: Longitudinal Study; Emotional Code; Gender Differences.

Chart IV.9 presents these results:

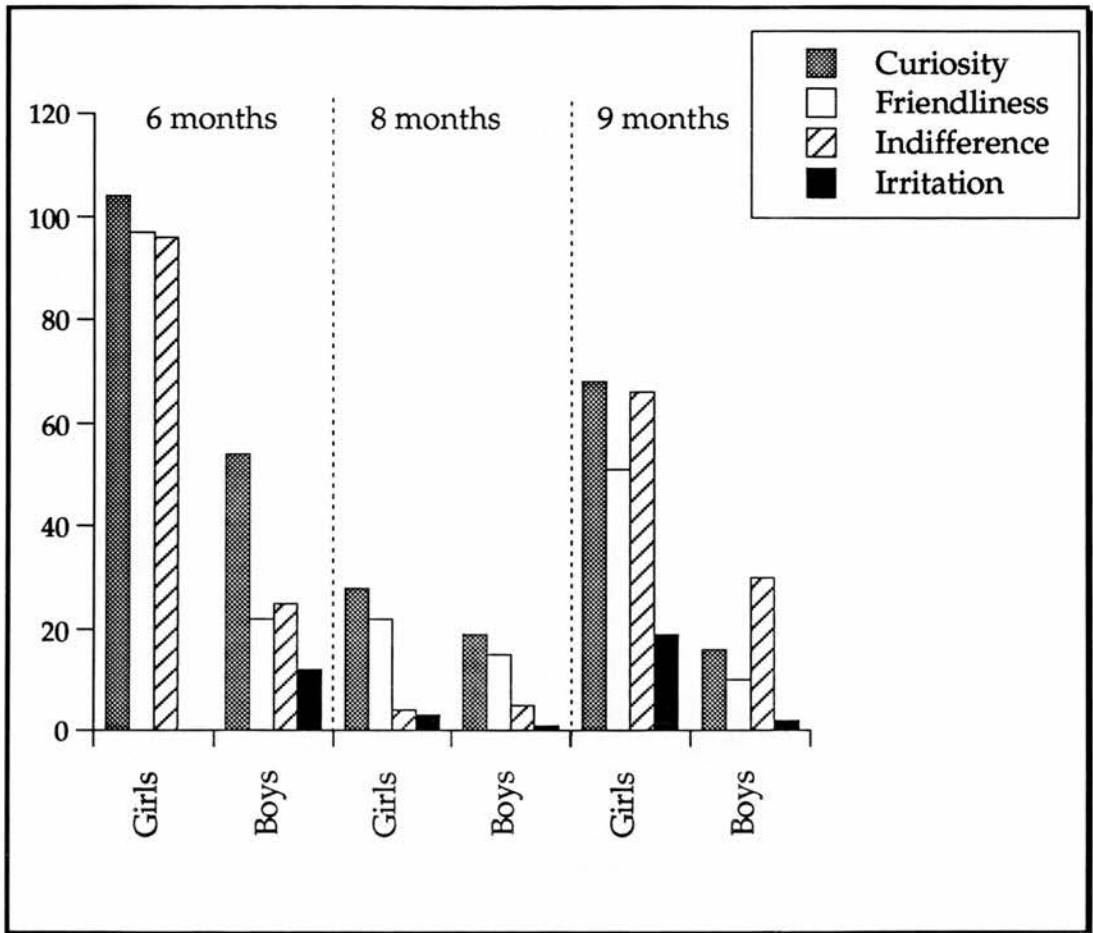


Chart IV.9: Longitudinal Study; Emotional Code; Differences by Gender.

2.2.3. Emotions by Infants' Dyads:

Table IV.10 shows the results for all the dyads, at all ages.

Boys seem to have more difficulties to express emotionally when confronted with boys, since no expression was recorded in those boys+boys dyads. This way, tables above confirm the results for gender, since no emotional expression was registered for boys interacting with boys.

These results also confirm the Cross-Sectional study for Emotional Code, showing a difference between girls and boys in emotional expression.

Chart IV.10 presents the results for infants' pairs.

A loglinear analysis was performed, to look for the best model that could fit these expressive situations. The results showed that a model of interaction among Gender+Age+Emotional code was the best to be considered. Statistical tests for this model show how significant it is:

Goodness-of-fit Statistics	Value	DF	Sig.
Pearson χ^2	72.691	17	.000000007
Likelihood Ratio	74.895	17	.000000003

This model means that there is an interaction among age, gender and emotional expressions (represented by the Emotional Code).

As infants grow, it seems that they tend to show more friendliness, curiosity, but more indifference, as well. In fact, this is an interesting result, which was not found in the Cross-Sectional study, where the infants were unfamiliar to each other. As mentioned before, this is an effect of habituation to another infant whom they have met before.

Again, here there is a very small amount of irritated expressions. This confirm the Cross-Sectional study, in the sense that infants probably use more friendly expressions when interacting with same age peers, at least in the first year.

	Ellen + Katie	Ellen + Andrew	Ellen + David	Katie + Andrew	Katie + David	Andrew + David	Totals
6 Months							
Curiosity	57	78	23	0	0	0	158 39
Friendliness	62	36	21	0	0	0	119 29
Indifference	65	34	22	0	0	0	121 29
Irritation	4	7	1	0	0	0	12 3
Totals	188 46	155 38	67 16	0 0	0 0	0 0	410 100
8 Months							
Curiosity	10	0	0	0	37	0	47 48
Friendliness	4	0	0	0	33	0	37 38
Indifference	0	0	0	0	9	0	9 9
Irritation	0	0	0	0	4	0	4 4
Totals	14 14	0 0	0 0	0 0	83 86	0 0	97 100
9 Months							
Curiosity	42	42	0	0	0	0	84 32
Friendliness	35	26	0	0	0	0	61 23
Indifference	48	48	0	0	0	0	96 37
Irritation	6	15	0	0	0	0	21 8
Totals	131 50	131 50	0 0	0 0	0 0	0 0	262 100

Table IV. 10: Longitudinal Study; Emotional Code; Infants' Dyads.

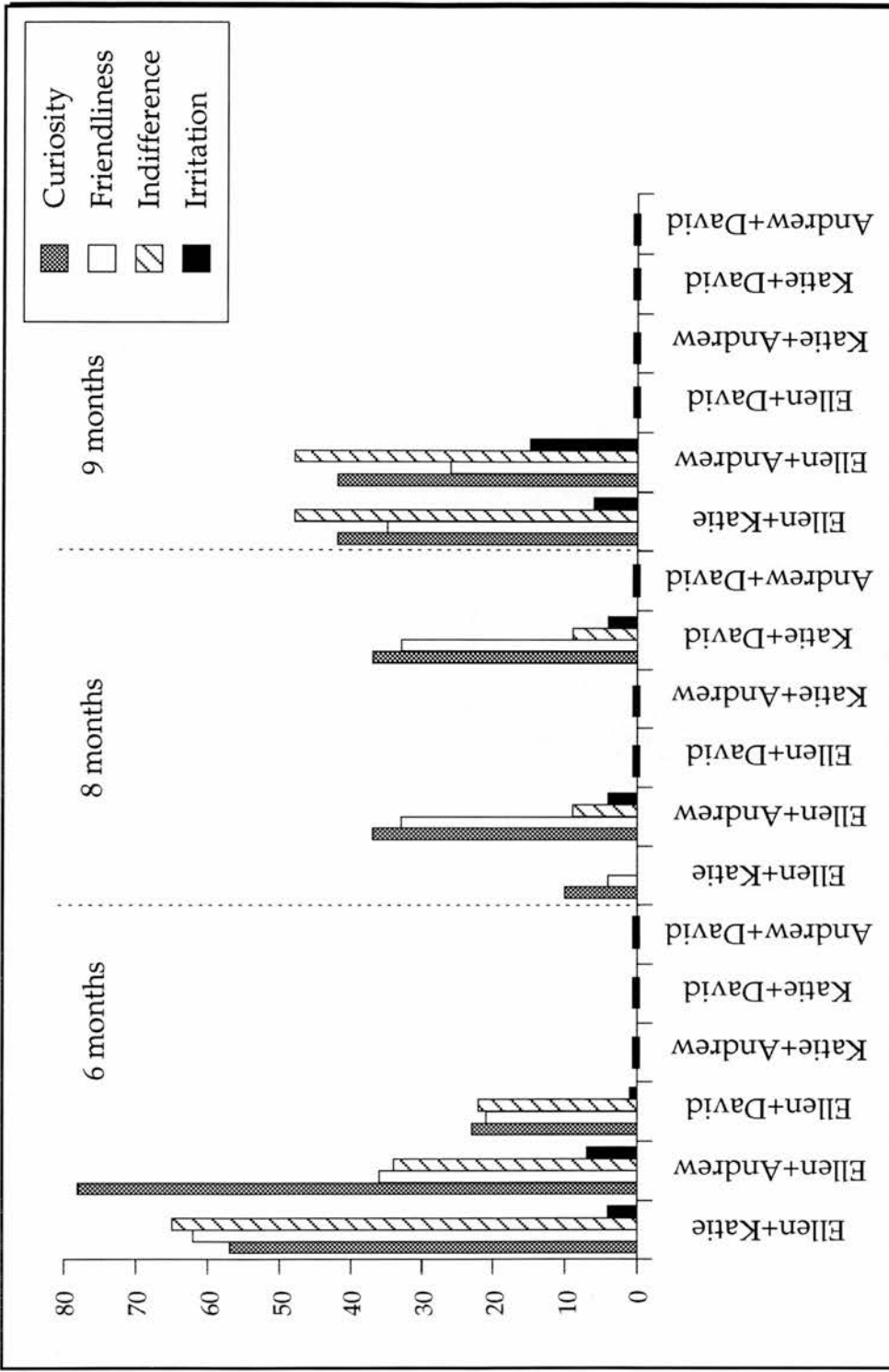


Chart IV.10: Longitudinal Study; Emotional Code; Gender Differences considering pairs of subjects in the three age groups.

3. MIRROR STUDY

3.1. INTERACTIVE CODE

As explained in the Methods chapter, the same infants who participated in the Cross-Sectional and Longitudinal studies were also invited to face their reflections in a mirror box.

The data were analysed according with age and gender.

3.1.1. Interactions by Age:

Table IV.11 shows the results for different ages⁸.

Although the number of subjects is different in each age, it is interesting to note that the vast majority of behaviours in the three ages is communicative. That means that, even at 6 months, these infants were very interested in their own mirror image and, they spent a high proportion of the time interacting with it.

⁸ The number of subjects is different in each age for two reasons:

a) All subjects involved both in the Cross-Sectional and the Longitudinal study were analysed. There were, therefore, more subjects at 6 months, than at 8 and 9 months.

b) In the 9 month group, one of the infants could not be recorded. There are, therefore, two subjects in this group.

	6 Months				8 Months				9 Months			
	Ellen	Katie	Andrew	David	Total	Holly	Monty	Thomas	Total	Emily	Stuart	Total
Distraction/ Avoidance	8	10	1	0	19	0	11	1	12	2	7	9
Communication	33	18	18	38	107	28	42	33	103	23	37	60
Total	41	28	19	38	126	28	53	34	115	25	44	69
	33	22	15	30	100	24	46	30	100	36	64	100

Table IV. 11: Mirror Study; Interactive Code

Chart IV.11 shows these results:

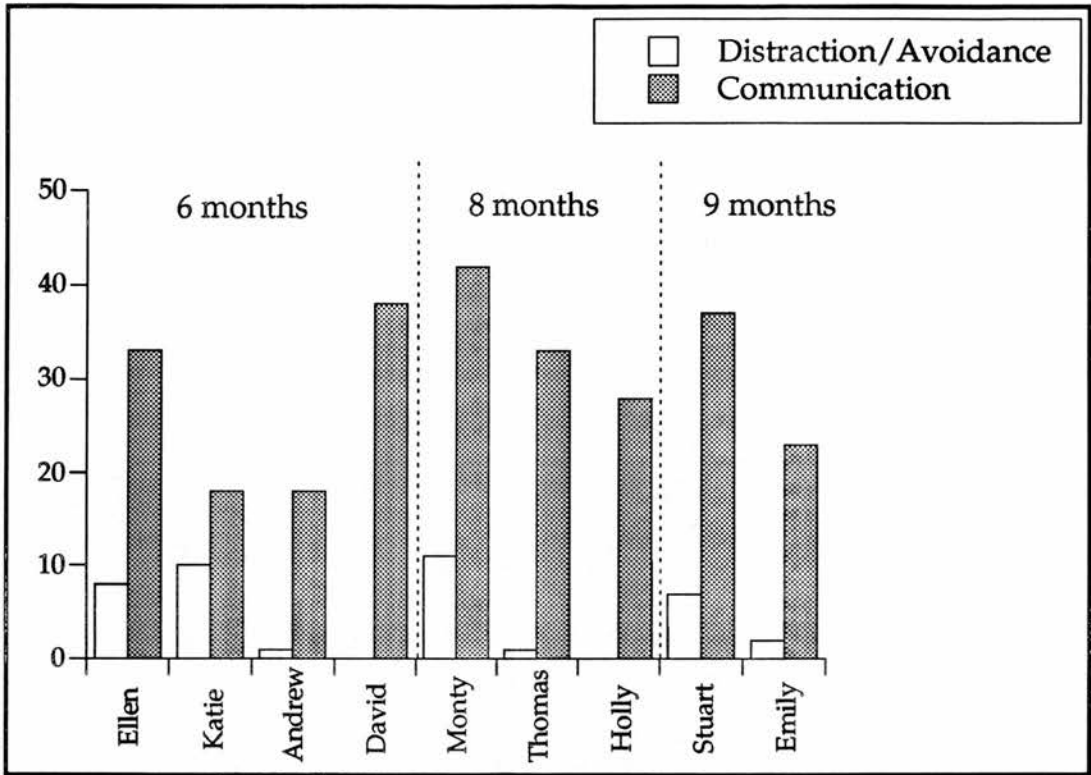


Chart IV.11: Mirror Study; Interactive Code; Differences between Communication and Distraction in each Age.

Because of the difference in the number of subjects in each age , it is not possible to calculate a chi-square combining the three ages. But it is possible to observe the differences between interaction and distraction in each age, which are highly significant at all three ages:

	Value	DF	Significance
6 months	61.46	1	0.0001
8 months	72.00	1	0.0001
9 months	37.69	1	0.0001

3.1.2. Interaction by Gender ⁹:

The most interesting result is the difference between boys and girls.

At 6 months, it seems that these boys and girls are very similar in the number of interactive expressions with the mirror images. If distractions are not considered, boys show 52% of the total and girls show 47% of the total interactions.

But at 8 and 9 months, the difference is much greater, with boys showing almost twice as many interactions as girls (boys, 76%; girls, 24%, at 8 months¹⁰; boys, 62%; girls, 38%, at 9 months).

Chart IV.11 shows these results, as well, observing the differences between boys and girls. Apparently as far as mirror images are concerned, boys are more interactive than girls.

A loglinear analysis was performed and the model fitting the data is one that shows an interaction among age, gender, and interactions (represented by the Interactive Code). Statistics show a very high significance for this model:

Goodness-of-fit Statistics	Value	DF	Sig.
Pearson χ^2	52.617	7	.000000004
Likelihood Ratio	56.880	7	.0000000006

⁹ Please, see Table IV.11 for the results for each subject.. Because the number of boys and girls is different in each group, it is impossible to make a table summing up boys X girls.

¹⁰ It is important to remember that there are more boys than girls at 8 months. However, if each boy is compared separately to the girl, they will still show more interactions than hers:

-Holly+Monty: Holly, 40%; Monty, 60%

-Holly+Thomas: Holly, 45.9%; Thomas, 54.1%

This model fits the results, showing that infants' interaction with their mirror image happen even at 6 months of age, and this interaction is probably different for girls and boys, with boys seemingly showing more interactive behaviours than girls.

3.2. EMOTIONAL CODE

The data were analysed according to age and gender in the Emotional Code of the Mirror study. As explained before, the Emotional Expressions for the Mirror study are not the same for the Emotional Code of the Cross-Sectional and Longitudinal studies.

3.2.1. Emotional Code by Age:

Table IV.12 shows the results of this analysis.

The first thing to be noted is that, in the Mirror study, the infants showed a larger variety of emotional expressions than in the Cross-Sectional and Longitudinal studies. Attentive expression was predominant in all ages groups. Apart from that, there are some differences among ages:

At 6 months, infants face the mirror basically with an Attentive expression (51% of the total). Other expressions are less frequent, but there is a significant presence of Friendly (16%) and Happy (13%) expressions. The negative emotional expressions, Irritated (4%) and Unsettled (8%) are very few, and were not obviously connected with the mirror situation, but with boredom and fatigue. A very interesting expression with two subjects at 6 months was Self-exploration (3%), which is not classified as an emotional reaction. These infants looked at the image of their hands moving, looked back at their hands, moving them, and then looked at the mirror again.

	6 Months					8 Months				9 Months		
	Ellen	Katie	Andrew	David	Total	Holly	Monty	Thomas	Total	Emily	Stuart	Total
Attentive	20	14	12	23	69	6	28	29	63	8	30	38
Distracted	0	0	0	0	0	1	0	0	1	0	0	0
Friendly	5	12	0	5	22	10	27	2	39	4	13	17
Happy	3	0	6	9	18	2	20	3	25	14	16	30
Irritated	3	1	1	0	5	0	2	0	2	0	0	0
Self-exploratory	1	0	0	3	4	3	0	2	5	0	2	2
Shy	1	1	0	0	2	5	0	0	5	1	0	1
Surprised	5	0	0	0	5	0	0	0	0	2	1	3
Unsettled	3	8	0	0	11	7	1	0	8	0	0	0
Total	41	36	19	40	136	34	78	36	148	29	62	91
	30	26	14	30	100	23	53	24	100	32	68	100

Table IV.12: Mirror Study; Emotional Code; All Subjects

At 8 months, although Attentive expressions were dominant (43%), Friendly expressions appeared with more intensity (26%), and a Happy expression was approximately the same as at 6 months (17%). Negative expressions dropped (Irritated, 1%; Unsettled, 5%). Self-exploration appeared again (3%).

At 9 months, Attentive expressions are still dominant (42%), but the positive expressions Friendly (19%) and Happy (33%) are also high. No negative expression was recorded at this age.

Chart IV.12 shows the results above.

A chi-square test and likelihood ratio show a very strong significance for age differences in emotional expressions:

	Value	DF	Significance
Pearson χ^2	219.114	64	.000001
Likelihood Ratio	204.858	64	.000001

These results mean that, as age progresses, infants show more positive emotional expressions, and eliminate negative ones when they are contacting with their own mirror image. Although the frequency of Self-exploratory expressions was not very high, the simple fact that they had occurred at 6 months opens an interesting field for discussion.

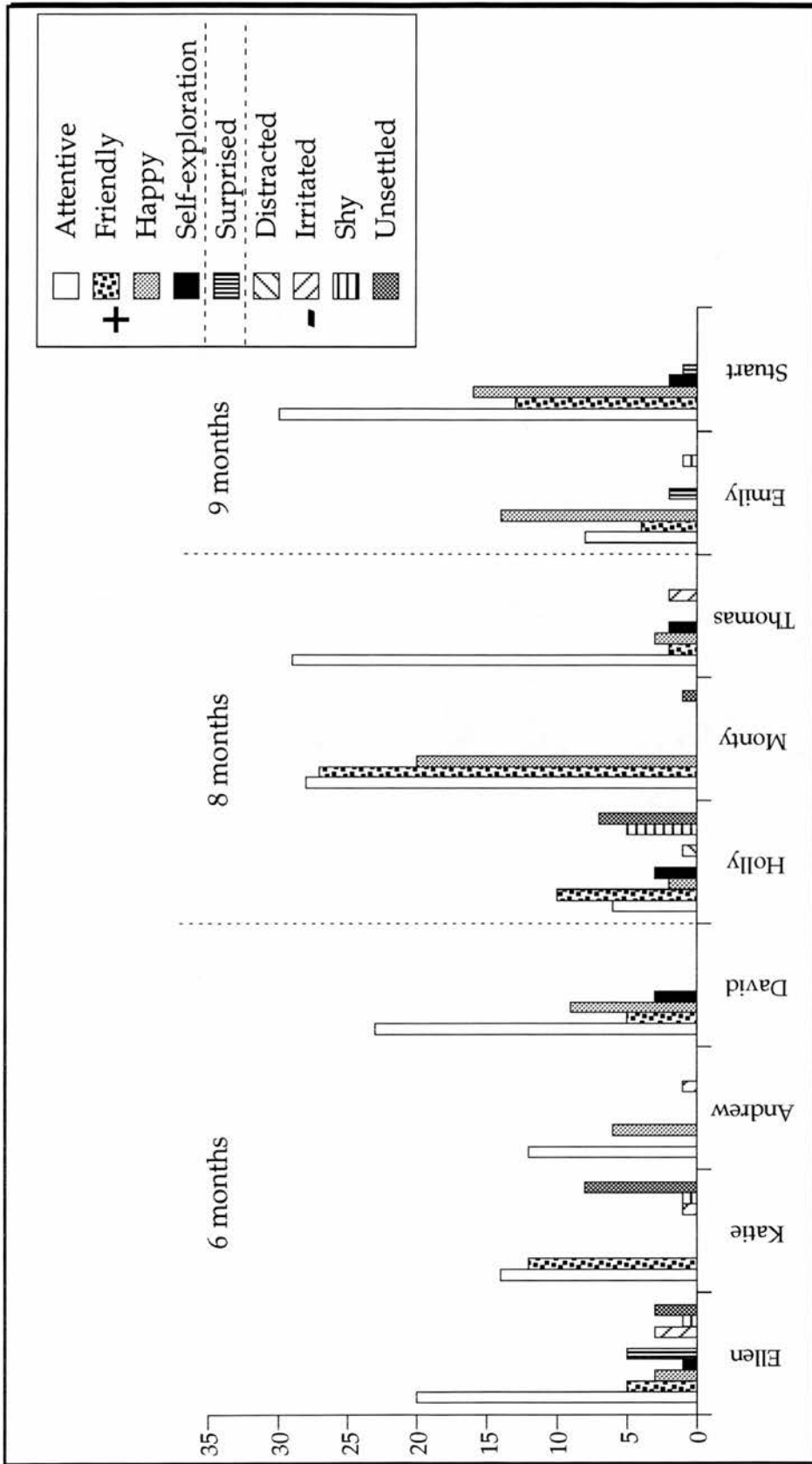


Chart IV.12: Mirror Study; Emotional Code; Differences by Age; showing each subject.

3.2.2. Emotions by Gender ¹¹:

Table IV.12 shows the results for each infant.

The results show a difference when compared with the Interactive Code.

At 6 months, girls are more expressive than boys, as far as emotional expressions, positive and negative, are concerned (girls, 77%; boys, 59%). At 8 and 9 months, however, boys are more expressive than girls (8 months: girls, 23%; boys, 77%; 9 months: girls: 32%; boys: 68%). Girls seem to go through all the different patterns of emotion, whereas boys tend to stay in the positive side. If only positive emotions are considered, then boys are superior in all ages.

Interestingly, boys never showed shyness in this study, when confronted with their mirror images. Although this category was rare (girls showed 1% of the total behaviours), this is an interesting result.

As it may be seen, the difference between boys and girls at 6 months is small. At 8 months, in one comparison (Holly+Monty), there is a significant difference, whereas in the other (Holly+Thomas), the difference is non-significant. This may be more a reflection of individual differences. At 9 months, the difference is significant. The statistical results for each age are very unclear, and this can be ascribed to the small number of subjects. If the three ages are considered together, then the statistical results become significant.

Chart IV.12 also shows the results for the Emotional Code of the Mirror Study.

A loglinear analysis showed that the best fitting model for this study had to consider the interaction among age, gender and emotional expressions.

¹¹ Please, see footnote 8.

Statistics show the significance for that model:

Goodness-of-fit Statistics	Value	DF	Sig.
Pearson χ^2	168.033	42	.00001
Likelihood Ratio	186.474	42	.00001

This means that there is a difference in gender across ages in emotional expression.

Summary of Results:

In short, the results for this research show the following general picture of what happens across ages in infant-infant interaction:

It seems that, at 6 months, infants do try to make contact, but, they lack the ability of keeping this contact going. As a result, invitations for interaction occur frequently, and they are not always followed by interactions. The infants react to one another with curiosity and they are friendly to the other infant, but as a result of an inability to keep their attention fixed for a long time on any one object, they score high on 'indifference'. This indifference does not imply disinterest, but rather a shift of attention to other objects. Indifference is characterised by a quick shift of attention away from the other infant to an object and then a shift to the other infant again. It is a negative communicative signal.

At 6 months, girls are apparently more interactive and more expressive than boys.

At 8 months, a change occurs towards more interaction and less indifference. Infants at this age seem to be able to keep their interactions going for longer periods, and they show much more interest in the other infant, with

no irritation at all. In fact, the interest shown is so intense that invitations occur with less frequency, and the interactions continue uninterrupted for several minutes. In one sense, this is not optimal communication, because turn-taking is necessary, but it does show that infants at this age have an ability to maintain a conversation. Girls are again superior to boys, both in interactive patterns and positive emotional expressions.

At 9 months, further development is apparent. Interactions and invitations are now much more equal, meaning that each infant is more able to give the other turns in their interactive strategies. Indifference also occurs, with the same level as that of 6 months, but somehow emotions seem very much more well-regulated. But, at 9 months, when infants already know each other from several previous meetings, they seem to be prone to indifference. This indifference is not just a shift of attention to another object, but an expression of withdrawal from the other, shown by behaviours like 'still-face', vocalisations directed to the self, eyes gazing the ceiling, and so. Girls were once again, found to be superior than boys in interactive patterns and emotional expression.

A very important element evident in all ages is the communicative use of imitation. Imitation is present in all ages, in all studies, and at a very significant rate. It seems that infants use imitations to help the interactions in all situations: to start it, to keep it going, and even to restore interaction, when it is failing¹².

Another important element is the very low rate of active negative emotions, like irritation. An explanation for this is that before the first year, when facing another infant, infants seem prone to use positive expressions to negotiate an interaction. A smiling face, waving and gentle vocalisations seem

¹² This point will receive a deeper analysis later.

to be a very effective way of gaining the other's attention. Whether or not this is a general characteristic, other research in other situations must show. No physical contact was allowed in this research, and no toys were shared.

The results above were obtained in a Cross-Sectional study and were confirmed by a Longitudinal study.

As for the Mirror study, a very interesting result is that boys seemed to be more interactive with their images than girls, and they also showed more positive emotional expressions. This result is opposite to the previous Cross-Sectional and Longitudinal studies. It seems that in front of their own images, boys feel more freedom to interact and to show positive emotional expressions.

At all ages, infants are very attentive to their mirror images. Their images attract them and make them show much richer expressions than when faced with another infant.

For the Emotional Code both in the Cross-Sectional and Longitudinal studies, just four emotional expressions were distinguished; Curiosity, Friendliness, Indifference and Irritation. In the Mirror study, however, many more emotions were coded; including Happiness, Surprise, Self-exploration (which is not a pure emotional expression, but is so "expressive" that it was decided that this behaviour should be included in that category), and Shyness.

At all ages, the amount of positive emotional expressions was superior, as shown also in the previous Cross-Sectional and Longitudinal studies. It seems that infants before the first year basically make use of positive expressions when confronted with another, be it another infant or their own mirror image.

The presence of clear self-recognition' (coded as self-exploration) as early as 6 months was of interest. This was not a large proportion of behaviours; it seems that the infant is fascinated by the image, but does not care whether it is his/hers or not. Nevertheless, in some situations, the infant is very surprised to perceive that the moving image of the hand in the mirror is of his/her own hand. The infant stops, moves the hand, looks at it, looks back to the mirror, moves the hand again. This lasts few seconds, but the recognition of the self is there.

It would be very exciting to use a double-TV system to observe how infants would react to others, because they will have somebody facing them who is not really there, as if it were a mirror image. But that mirror image will not react automatically, as a self-image would. Probably, the interactions will be more similar to the Cross-Sectional and Longitudinal studies.

The results shown above are exciting, and many of them were not obtained before. However, they must be interpreted with care. As explained in the Purposes section, this is an exploratory methodological study with very few subjects. There were clearly individual differences, apart from those due to age and sex which must be taken into account.

Chapter V

DISCUSSION

The results obtained in this research raise new questions concerning infant-infant interaction. Some contribute to the discussion concerning gender differences, and there were unexpected emotional reactions of infants to their mirror images.

As it was said in the Purposes of this work (chapter I), this was intended to be a pilot investigation of infant-infant interaction. The results must be seen as a provisional test of the methodology. It is clear that new research must be done, to confirm the findings.

The small number of subjects makes some of the conclusions precarious. Nevertheless, the behaviours observed do confirm the main hypothesis, that infants, as young as 6 months of age, are capable of communicating with their peers. A difference between boys and girls was found in emotional expression, girls being more expressive than boys when confronted with their peers. The fact that the behaviours of only three girls and six boys were analysed could lead us to think that maybe this finding merely reflected chance individual differences, but this result on sex differences is compatible with that obtained by Maccoby (1980).

1. Infant-Infant Interaction

The results clearly show infants aged 6 to 9 months interacting with each other, and the interactive patterns are clearly defined. Each knows exactly

that the infant in front of them is another human being, not a toy, contrary to Kagan et al (1975), who think that, until 2 years, children are unaware of the presence of another one. In this study, every infant is clearly aware of being with the other, and keen to explore the possibilities of sharing experiences. The fact that communication showed is emotionally toned makes it more fascinating, because this means that motives are guiding this communication. These motives for intersubjective exchanges (Trevarthen, 1974, 1979, 1987) are forming the basis for later friendship and companionship among peers.

According to Tronick (1989), infants experience periods of interactive errors in normal interactions with caretakers, followed by negative affect and sympathetic 'repairs', with the transformation of the negative affect to a positive one. This experience gives the infant experience with the ability to establish positive interactions, seeing him or herself as effective, and the other as reliable and trustworthy. I think the same kind of 'error' happens in infant-infant interaction, although they are not often followed by negative affect. Infants simply turn their attention to other stimuli in the environment, seeming to 'forget' the other's existence for some time. Interactive repairs seem to be brought into effect by the 'offending' partner, not by the infant who withdraws from the interaction. The other infant displays a series of behaviours that were effective when the interaction started, such as, imitation of behaviours, vocalisations, body movements, and so on. In most of the situations, these strategies seem to work, for the avoided infant was successful in restoring the previous interaction. Interesting, though, that once he (or she), regains the partner's attention, he (or she) seems to take his (or her) turn, withdrawing from the interaction. Now it is the other's turn to display the attractive behaviours, trying to renew the interaction.

At 6 months, Interacting and Imitating behaviours already exist, but interactions are not consistent, and they are often interrupted by shifts of attention. In fact, at 6 months, infants seem constrained to repeat invitations to their partners, seeking to engage them. They call each others attention, but together fail to keep the interaction going.

At 8 months, there is an increase in interactive situations, which appears to show that infants are becoming more able to direct their attention to become involved with another infant, overcoming the impulse to shift attention away.

Finally, at 9 months, periods of Interacting rise to almost half of all the interactive situations, clear indicating that infants are now in control of their interactions.

These results are to be expected, if we accept that as infants grow, their range of interests is extended, and can be better sustained.

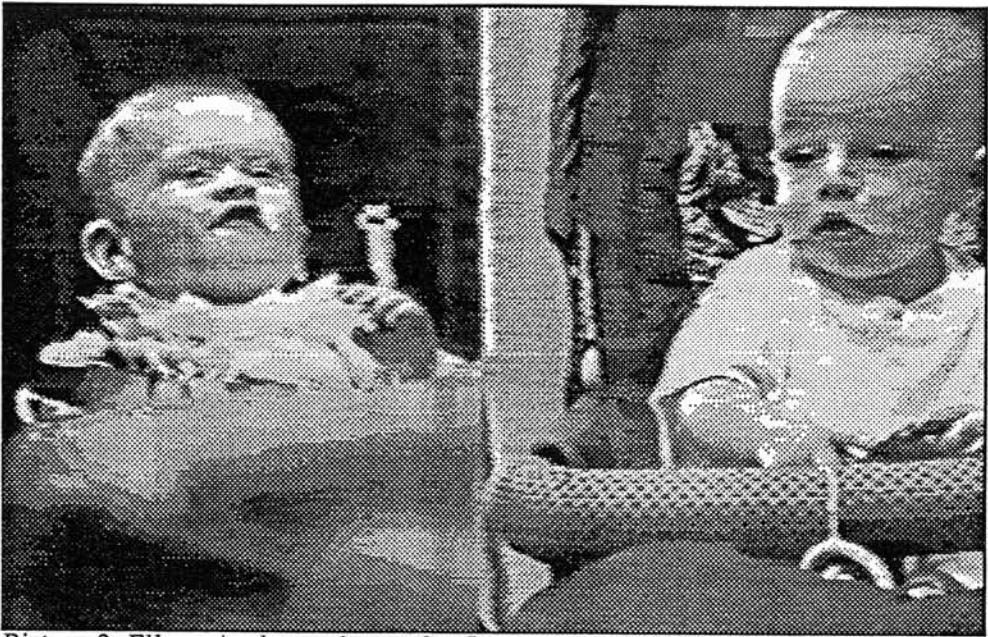
Take as examples of these developments, Ellen and Andrew, a pair of 6-month-olds (Pictures 1 to 5, below). They were sitting in front of each other, and Ellen starts to try to call Andrew's attention. He is not very responsive, he is more interested on a toy that he found in his push-chair. But Ellen insists, moving her body up and down, making a funny pout, vocalising loudly. He finally looks at her, who triumphantly goes on with her "showing off", lifting her legs, and feet, vocalising and smiling. But she gives him a turn, and waits as he moves his body forward, shakes the toy and smiles. At the end, both are happily smiling to each other.



Picture 1: Ellen+Andrew, 6 months: Invitation (Ellen is calling Andrew's attention, who is more interested in his push-chair straps).



Picture 2: Ellen+Andrew, 6 months: Invitation (Ellen is still trying to call Andrew's attention, vocalising loudly; he is looking to his right).



Picture 3: Ellen+Andrew, 6 months: Interaction (they are looking at each other and vocalising in turns, moving their bodies).



Picture 4: Ellen+Andrew, 6 months: Interaction (they are looking at each other; she is "showing off", and he is looking very suspiciously to her).



Picture 5: Ellen+Andrew, 6 months: Interaction (this picture shows both of them "having fun", vocalising and laughing at each other).

Infants' interactions with other infants appear to be regulated by sympathetic exchange of expressions, in the same way as infants interactions with adults. It is clear that they do not need 'scaffolding' of the mothers or other adult to generate interactions. Jacobson (1981) claims that infants' interaction at 6 months must be mediated by toys. In my experience, this is definitely not the case. Even at 6 months, pairs of infants were able to share interest and become involved in a conversation-like behaviours, by means of vocalisations, body movements and emotional expressions. When, in very few cases, toys were used, they were made "part of the game", in the sense that infants teased each other with the help of the toy or used a toy to call the other's attention, but the same communicative performances were apparent without toys. Actually, in some situations, toys distracted an infant, who became more interested in the toy than in the peer.

The role of imitation in infants' interaction was made very clear in these results. Imitation was used to assist interactions, in many different circumstances, for example:

1) Infants can start a 'conversation of movements' through imitative behaviour, and, as the interaction progresses, they take turns and a "conversation" in the form of attuned reciprocal body movements can be observed. For example, Holly and Monty, at 8 months are facing one another; the boy looks at the girl and starts to kick and the girl imitates him immediately, looking at him. He kicks back and she does the same, but vocalises, smiles, points at him, while he is greatly impressed by the presence of another infant in front of him and kicks back, vocalising to her (Pictures 6 and 7).



Picture 6: Holly+Monty, 8 months: Imitation (Monty looks at Holly and starts to kick; she kicks as well).



Picture 7: Holly+Monty, 8 months: Imitation (Both infants are kicking, at the same time, and Holly vocalises).

2) Infants use imitation to synchronise their behaviours. This synchronisation was called *sympathetic attunement*, in accordance with Stern's concept (Stern et al, 1985). They make the same movements with their bodies at the same time. In the above example, in two minutes of interactive situations, there were 28 imitations, all of them showing such attunements.

3) Imitation is also used to keep the movement-conversation going. At 9 months, Emily and Stuart imitate each other in this sort of movement-conversation. He kicks and holds his leg up, and she imitates him, but not with the exactly matching body movements. First, because she is not so "athletic" as he is (he can put his legs in a higher position than she can) and second, because as he kicks, he vocalises in a long and loud way ("Tarzan-like"), while she smiles. As his attention shifts to other things, such as investigating his push-chair screws, she tries to call his attention back, kicking and moving her legs up. She succeeds, because he imitates her and emits his "Tarzan-like" call again (Pictures 8 to 10).



Picture 8: Emily+Stuart, 9 months: Imitation (Stuart lifts his legs and holds them, vocalising. Emily lifts her legs, as well, looking at him).



Picture 9: Emily+Stuart, 9 months: Imitation (Emily kicks her legs, and moves her right leg up and vocalises, as Stuart is playing with his push-chair straps).



Picture 10: Emily+Stuart, 9 months: Imitation (Stuart looks at Emily, lifts his legs and vocalises; she points at him, lifts her legs and vocalises, as well).

4) Imitation may serve to express recognition and sympathy. Again, two 9-month-old infants, a boy and a girl were interacting (Picture 11). He looks at her, vocalises an "a-haa" sound and waves his hand, jumping in his push-chair. She smiles at him and waves back, vocalising a "uu" sound. He laughs at her and waves back again.



Picture 11: Emily+Angus, 9 months: Sympathy (Angus waves to Emily and she waves back, smiling and vocalising).

5) Imitation may also be used to tease or provoke the other. At 9 months, a boy keeps shaking a toy, holding it in front of a girl at the same age (Pictures 12 and 13). She imitates his hand movements, and vocalises "uu", pointing as well. As she tries to reach it, he jumps and shakes the toy again, evidently finding pleasure in provoking her efforts. She also seems to be pleased, because she keeps smiling and vocalising, showing no distress that she cannot get the toy (Fiamenghi, 1997).

It is clear, then, that imitation is a very important component of infant-infant interaction. These results are in accord with those obtained by other researchers investigating mother-infant imitation (for example, Kugiumuzakis, 1983).



Picture 12: Emily+Adam, 9 months: Teasing (Adam shakes the bally, and Emily smiles, vocalising).



Picture 13: Emily+Adam, 9 months: Teasing (Emily points at the ball, again, and Adam smiles and shakes it).

'Invitation' was another interesting category of behaviour. It indicates a tendency to interact, but also in most cases corresponds to a lack of ability to make interactions contrive to operate. It is a very effective behaviour, though, and infants at 6 months use it most of the time. In fact, that seems to be one importance difference between infant-infant and adult-infant behaviour interactions. Many researchers (Fogel & Hannan 1985; Kaye & Fogel, 1980; Maratos, 1973, 1979; Meltzoff & Moore, 1989; Nadel & Fontaine, 1989; Nakano, 1994; Trevarthen, 1974, 1984, 1987, 1990, 1993; Vinter, 1985; Weinberg & Tronick, 1994) have shown that mothers are very effective in keeping an interaction going.

I conclude that basically, there is no qualitative difference in motivation between infant-adult interaction and infant-infant interaction. Infant-infant interactions follow certain of the same patterns as those reported for infant-adult interactions, such as mutual attunement, synchronised timing of

behaviours, turn-taking and empathy of feelings. However, adults are certainly more efficient in creating and maintaining *topics* (Nakano, 1995). Topic, here, is used in the sense of an object or action of shared interest. For example, the mother can call the infant's attention by showing him or her a toy and shaking it in front of his or her eyes, smiling and vocalising. Because of that, infant-infant interactions will be less frequent, and much more shorter, than adult-infant interactions, especially at earlier ages. When confronted by adults, infants are encouraged to keep their attention to the adult by the adult's efforts. A parent will persistently call the infant's attention, inviting with smiles and vocalisations and trying to keep his or her gaze, adopting new strategies if the infant turns away. Maybe, then, mothers are more capable of turning their invitations into effective interactions.

Because infants cannot create as many topics as adults, many of their invitations fail to attract or sustain interactions. Sometimes, the infants use vocalisations, that were called *Determined*, in the sense that they persistently try to attract the other infant's attention. These vocalisations are longer and louder than the ones that seem to be used to call the other's attention (called *Attention*). In general, they start with an *Attention* call, but, if it does not succeed, they can use the *Determined* one. But, even these stronger attempts fail in many situations, due to the infants inability to create a new attractive topic for their partner once they have succeeded in attracting the partner's attention. As age progresses, infants seem to be more able to create and/or pick up topics, and, in fact, at 9 months interactions and invitations are effectively combined, meaning that at this age infants invite and are successful in obtaining an interactive response to their invitations.

2. Emotional interactions

There is a clear predominance of positive over negative emotions in these infant-infant interactions. Actually, infants showed more than twice as many positive emotions as negative ones. And, even in the case of negative emotions, the most common was 'Indifference'. No aggressive or angry emotional reaction was recorded.

As could be expected, emotional responses increase with age between 6 and 9 months. There was a drop at 8 months, though. This drop may have been due to special characteristics of the sample, but also could mean that at eight months, infants are experiencing a transition, a 'difficult period', with less external displays of emotion towards another infant, although remaining interested in exploring their environment.

The results of the Longitudinal Study were different. In that study, as age progresses, from 6 to 9 months, emotional expressions decreased, with an increase of 'Indifference', which did not appear in the Cross-Sectional Study. The explanation may reside in the fact that, in contrast to the Cross-Sectional Study, where infants were seeing each other for the first and only time, in the Longitudinal Study infants already recognised one another by 9 months. They were not attracted by the novelty of the other infant and reacted with indifference. They still showed curiosity and friendliness, but indifference was predominant in 9 months. Actually, a comparable result was also reported by Jacobson (1981), studying peer-peer-object interactions with toddlers. He concluded that "infants engaged in more manipulative play and less social interaction when the familiar peer was present", and "interest in toys is apparently diminished, in turn, by the presence of a novel peer" (p.623).

An important result was the fact that aggressive expressions were not recorded in any of the studies. In fact, the most aggressive of the emotional expressions recorded was irritation, but even so, it appeared in a small amount.

It seems that, at 6 months, infants are not, in this situation, in complete control of their emotional system, or of the circumstances to which they have emotional reactions. They shift from one emotion to another very quickly. As age progresses, they tend to maintain a positive emotional state. It was interesting to see that infants seem to use positive expressions in the majority of interactive situations with other infants. For some reason, up to 9 months, aggressive behaviours are not expressed very much, and the only negative reaction was indifference, which is a fairly passive avoidant emotion.

If these results can be generalised, then there is an interest to know when children start to use aggressive behaviours towards other children. On the other hand, in this study, infants were not in physical contact with each other. They were strapped on their push-chairs, out of reach of each other. Aggression may occur when infants invade each other's 'territory', getting hold of the other's toy, or touching the other's body. But, Hay, Nash & Pedersen (1983), studying 6-month-old infants interacting with each other also observed very little negative reaction to being touched by another infant. In fact, the infant's reaction to being touched was to touch back. This absence of negative reactions in their research is in agreement with the results of this thesis.

Tronick (1989) proposes that infants' emotions play a critical part in an evaluation of their goals. For instance, emotions motivate the infant to react when attainment of a goal is hindered by an obstacle, causing them to remove it. Tronick believes that the emotion does not disorganise behaviour, but instead organises it. In some ways, the results of this thesis agree with that

interpretation. The subjects never showed any disorganisation in their behaviours when interacting with others. It seems that emotions are helpful in engaging the infant in interactions with peers. They effectively serve a social-regulatory function (Trevarthen, 1985).

On the other hand the results are completely contrary to the conclusions of Eckerman & Stein (1990). These authors believe that, before two years of age, infants seldom coordinate their actions to the specific actions of their partners. The subjects in this thesis are all much younger than two years. Even at six months they showed coordination in responding to their partners' communicative requests.

Trevarthen (1993b) says that "for a partner seeking communication, the features of the subject's motivation become symptoms of the inner psychological activity of the individual who is generating and coordinating them" (p.126). That is what seems to have happened with the subjects of this study. As the other infant shows any behaviour towards the other, it is immediately perceived and responded to, in a sympathetically synchronised mode, by the infant who is seeking communication. He (or she) reacts in an integrated way, emotionally attuned to the needs of the other, who, in turn, will respond again, and thus a smooth communication of motive states is accomplished between them. No matter what kind of behaviour is displayed, the other infant seems to understand its emotive meaning immediately, and reacts precisely to it. When he (or she) fails, communication is interrupted. But, having learned how the other is, he (or she) can restore the interaction, by using some common "sign" that was previously shared (such as kicking, vocalising, smiling, waving, and so on). This is a sharing of inner motives, and emotions are playing their part as effective communicative regulators of self-other relations (Trevarthen, 1993a).

3. Gender Differences

The results show that a difference between boys and girls in their interactive patterns. Girls seem to interact more, to imitate more and to try to initiate an interaction more than boys do. There are certainly individual differences, as well. Some boys interacted more than others, but the 3 girls were significantly more interactive than all boys. When interactions between boys are compared with interactions between boys and girls, the results show almost no communicative responses for boys with boys. In fact, only two boys interacted with each other in three age groups all groups¹³. In truth, gender differences were not a main concern of this thesis, nor was it intended to analyse them. But, when the statistics were done, the model revealed by the loglinear analysis included gender as a significant factor, meaning that gender played an important role in the results. Gender was, then, a point of discussion for this thesis.

Differences between boys and girls also happened in relation to the emotional expressions showed by the infants. In all categories, girls were more expressive than boys, showing more curiosity and friendliness, as well as indifference.

Gender differences is a very polemical issue, basically because people tend to believe that in any fair appraisal differences must be due to cultural factors. In fact, culture cannot be forgotten when considering gender differences

¹³As there was just one girl-girl dyad, in the Longitudinal Study, it is impossible to make reliable comparisons. Nevertheless, it is suggestive that these two girls were more interactive than any of the situations when boys interacted with boys.

(and, maybe thus is true of all psychological constructs), but there are probably innate characteristics that could account for differences in infants' interactions.

Feminist theorists totally reject any suggestions of an innate basis of gender differences. Chodorow (1978), referring to studies that show a biological basis for gender differences, says that "even if we want to read these studies as supporting or even partially supporting a biological argument, the conclusions we can draw say nothing about the effects of *female* hormones on maternal behaviour, feelings or preferences. They suggest only that *male* hormones may suppress maternalism" (p.25). Basow (1992), also from a feminist standpoint, says that there is no evidence for gender differences, because gender is constructed by every socialising agent in society.

The subjects here, however, were too young to be influenced by social roles. Even though it could be argued that even infants observe their parents' behaviours and reactions to the world and to their children, it is very difficult to believe that a 6-month-old, who has never been interacting with another baby before, would apply this experience, generalising to the infant from experience of adults. Besides, how do they know that the other is a girl or a boy? This is probably not a category that infants have developed yet at the ages this study includes. It would appear that feminist justifications for gender differences do not apply here.

The differences in gender that were found here seem to agree with Maccoby (1990), who believes that interactive behaviour is not just situationally specific, but it depends on the gender category membership of the participants.

There are, in fact, many possibilities that could explain those differences between boys and girls in this small sample. The first could be individual differences among boys and girls. This is something to consider. Nevertheless,

the same pattern of gender differences was found in both Longitudinal and Cross-Sectional studies, which is a sign that gender is playing a part in the interactive patterns of the infants.

Another explanation could be the ways mothers behave with boys and girls. Lindahl & Heimann (1995) concluded that mother-daughter interactions are characterised by a higher degree of social proximity than mother-son interactions. If social proximity is an indication of the quality of social interaction, this could account for the higher degree of interactive behaviours showed by the girls in this study. Mothers may stimulate more interactive behaviours in their daughters, who will show more of these behaviours when relating to other infants. And as these interactions with mothers are affectively toned, girls will also be more expressive in their emotions to others infants.

The fact remains that gender differences occurred, both in Interactions and in Emotions. Gender differences were not the main concern of this thesis. Clearly, further research should carefully address this problem more specifically, from the beginning, structuring the samples with a similar number of boys and girls.

4. Mirror interactions

Contrary to the Cross-Sectional and Longitudinal studies, where observations followed a strict methodology, the Mirror study was a very free procedure, and, as a result, some interesting discussions can be made of it.

In first place, interactions of infants with their own image were the most frequent behaviours. Very few 'distractions' were recorded, contrary to the previous studies of infant-infant interactions, which were punctuated by

withdrawals. It seems that the mirror attracts infants' attention and, even at 6 months, they will spend a considerable amount of time exploring their own images in the mirror.

Another difference from infant-infant interaction is that boys are more interactive than girls, when facing a mirror. This is an unexpected result - common sense might lead one to expect that women spend more time than men in front of the mirror! This is not true, at least for infants.

As to emotional expressions, if only positive ones are considered, boys are more expressive than girls when confronted with a mirror image, although girls cover a broader spectrum of emotional expressions. No boy showed 'shyness', and this result seem to be in accordance with Lewis et al (1989). In his study, he found that females showed more 'embarrassment' than males.

An interesting result was that, at 9 months, no negative expression was recorded.

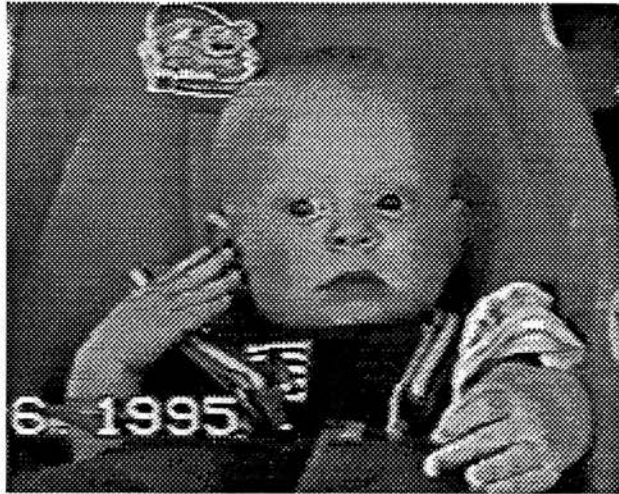
A controversial point concerns to the concept of self-awareness, or self-recognition. The majority of authors consider that self-recognition develops after the baby is at least 18 months old, and the sign for this is that the child touches the nose, when it has been previously marked, surreptitiously, with a rouge dot. Amsterdam (1972) claims that it is highly unlikely that a child will touch the face of another child if one with a spot on the face appeared in front of him or her. The question here is why is this unlikely? The test of a child touching his (or her) own face when it has been marked with a dot proves that the child recognises the dot, not himself (or herself). Maybe the child finds it strange to see a mark on his or her nose and then touches it, because he or she knows that the dot should not be there, because of prior experiences of self-recognition.

According to Zazzo (1993), at 12 months, although infants play with the mirror image of their hands, they do not recognise themselves. He considers the nose dot touching as a criterion for self-recognition. How can the baby recognise his (or her) own hands and not recognise them as part of himself (or herself)? Even if the reaction is simply to a moving object at first, the infant will soon become aware of the difference between an event that is independent of his or her movements and one that is strictly related to them. Only if one considers that self-recognition must be a consequence of a cognitive system that takes more than a year to develop.

Pictures 15 to 18 show an 8 month-old boy looking in astonishment as he recognises his own hand in the mirror. It is clear that he is interested in comparing the two ways of perceiving his hand move.



Picture 14: Thomas, 8 months (he is moving his hand and looking at the mirror image).



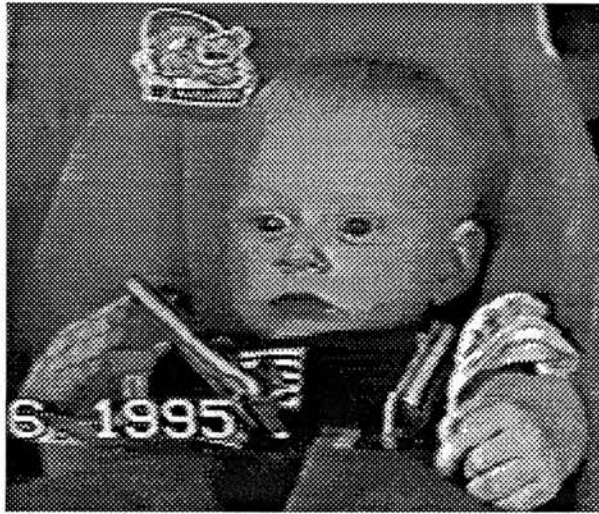
Picture 15: Thomas, 8 months (he opens his hand and stares at the mirror image).



Picture 16: Thomas, 8 months (he looks at his hand, showing surprise, eyes wide opened).



Picture 17: Thomas, 8 months (he looks at his hand, still seeming surprised).



Picture 18: Thomas, 8 months (he looks back at the mirror image).

In this study, infants were considered to be recognising themselves in various situations, when they were looking at parts of their bodies (mainly hands) reflected in the mirror, and suddenly looked to the real body part and moved it and looked back to the mirror image and back to the body part. I

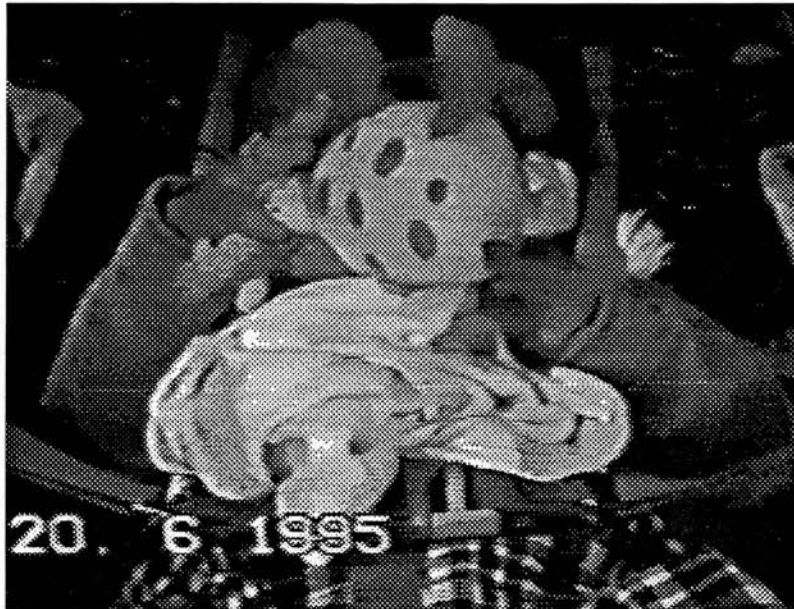
Lewis et al (1989) argue that specific cognitive skills are necessary for the emergence of secondary emotions, like embarrassment, for example. But Reddy (1992) has shown that shyness can be observed in 2 month-old infants. And, in this thesis, an 8 month-old girl, Holly shows what was called "shyness": after looking at the image of her own moving hands reflected in the mirror, looking back at the hands, still moving them, and then, looking at the mirror, she covers herself with some clothes and toys that were in the push-chair, hiding herself (Pictures 19 to 21). According to Lewis et al, she could not do that, because she does not have the cognitive skills yet. But she does. The explanation, then, is that emotional awareness is not dependant on cognition. Stern (1985) claims that a sense of 'self' is present from birth. And, with it, a sense of other. Infants do not have to learn how to differentiate themselves from the mothers. They are already differentiated.



Picture 19: Holly, 8 months: Shy (she covers herself with a cloth).



Picture 19: Holly, 8 months: Shy (she now uses a soft toy to cover herself).



Picture 20: Holly, 8 months: Shy (she is now completely hidden).

Other pictures showing infants in happy interactions with their mirror images are presented in Appendix 3.

Chapter V

CONCLUSION

This thesis aimed to investigate a new methodology for the study of infant-infant interaction and to observe what happens when infants are facing other infants, without any other stimulus. Both Cross-Sectional and Longitudinal observations were made, covering the age range from 6 months to 9 months. It has shown that infants can interact with each other from an early age (6 months), and that interactions are punctuated by imitations and emotional expressions, such as those of curiosity, friendliness, indifference and irritation. Also, it has shown that an infant does not need a mother's behavioural 'scaffolding' to communicate.

It seems that infants prefer a friendly approach when interacting with other infants, expressing positive emotions by smiles, laughs, wavings, and also by imitating the behaviours of the other. As far as gender differences are concerned, girls appear to be more interactive than boys, and also to show more emotional expressions. These conclusions appear to be supported by both the cross-sectional and longitudinal studies.

The fact that no aggressive behaviours were recorded may be due to the methodology; infants facing one another strapped to their push-chairs cannot directly act to make aggressive contact with aggression, but they could have tried, and this never happened.

A mirror study also showed a number of interesting results. Boys were more interactive with their own image than boys, but girls showed a greater

variety of emotional expressions. On the other hand, boys were more positive in their emotional expressions when facing their mirror image.

As was explained in the previous chapter, mirror studies with infants, children, primates, and even with dolphins, have always been primarily concerned with a test of self-recognition, based on evidence of awareness of the location of a 'nose dot'. The age at which children begin to recognise themselves as the person reflected in the mirror has been determined by recording when a child seeks to touch or remove a dot that has been covertly placed on the child's nose.

William James (1892) is credited with having established the foundations of the study of the self in Psychology, with the differentiation between 'I' and 'Me'. In James' theory, 'I' systematises and clarifies the subject's experience 'subjectively' - this experience is continuous over time and specific in comparison with others, providing the subject with a distinct identity. 'Me' is the object of the subject's perception when he or she reflects on himself or herself, including all categories that are used to define the subject in society, such as by age, gender, race, and so on.

However, it was Mead's theory (1934) that has given support for the current view in the study of the self. According to his argument, infants are not born with a self:

"The self is something which has a development, it is not initially there at birth, but arises in the process of social experience and activity, that is, develops in a given individual as a result of his relations to that process as a whole and to other individuals within that process".

(Mead, 1934, p. 135)

Although Mead was more concerned to acknowledge society as the fundamental source for the structure of the mature self, psychological researchers since his time have preferred to focus on the first more hypothetical part of his statement, that infants do not have a self at birth. As a consequence of this hypothesis, mirror self-recognition has been assumed to be only possible after the child has developed some kind of reasoning, a reflection of experience, which must happen after infancy, probably after the second year, as language is acquired. Thus, the preferred definition of self-recognition in contemporary developmental Psychology and the methodology used to test it, has disregarded the importance of affectively regulated relationships of awareness of the other.

It is curious that researchers seek to attribute self-recognition in this way to highly social species such as humans, primates and dolphins, failing to perceive that these animals' 'selves' are connected to the group in which they belong, as indeed, the researchers point out (Hauser et al, 1997; Marten & Psarakos, 1995; Tobach et al, 1997). In the case of humans, our sense of self is intimately connected to our relation to the others, and an awareness of the 'other' in the mirror is a good example of this essential sense of relatedness in dynamic interaction.

In the mirror test of this thesis, infants were clearly observing their own behaviours and interacting with their own images. They were certainly interested in the effects that their behaviours had upon themselves *and potentially on the others*, because they showed socially significant emotions, like 'shyness', 'shocked surprise', 'friendliness', for example, which are just the kind of expressions that are displayed in animated interactions with other persons. Therefore, I would suggest that the interactive emotional behaviour displayed by an infant in front of a mirror is the way of being aware of himself or herself,

but also it is a reflection of the natural awareness of the other. In fact, this view is shared by Reddy (1994), who believes that self-awareness is only possible in the context of other-awareness. Without the other, indeed, there is no possibility of self-awareness, or self-appraisal. As Adam Smith (1759/1982) explains, with perfect clarity, the self is in relation with the other who is aware of us:

"We suppose ourselves the spectators of our own behaviour, and endeavour to imagine what effect it would, in this light, produce upon us. This is the only looking-glass by which we can, in some measure, with the eyes of other people, scrutinise the propriety of our own conduct".

(Smith, 1759/1982, p. 112).

This thesis has employed a small number of subjects and there are different numbers of boys and girls. Clearly the results will be affected by the considerable individual differences between infants, both as to consistent temperamental diversity and patterns of development. Nevertheless, individual differences or not, the behaviours indicative of intersubjective recognition occurred, and differences observed between infants at distinct ages and between boys and girls do appear to give evidence suggesting that the results of this thesis would be confirmed in larger groups of subjects.

Psychology lacks agreement about the theoretical framework to analyse the phenomena of behaviour. As a result, partial views of reality are offered as if they were the total reality. Because of a bias of this kind, which can even take the form of an obstinate refusal to see what is there to be seen, many researchers have failed to replicate the results claimed by previous studies of the

communicative abilities of infants and, as a consequence, it has been decided that the behaviours claimed were not feasible. I believe that such narrow-mindedness cannot be justified in a science which deals with the behaviours of human beings, changeable and multifarious as these are. Psychologists should be the first to recognise that a more flexible approach is needed to observe human beings correctly.

Maybe because we live in a highly pragmatic western culture, we have a tendency to dichotomise everything. There is a feeling of security when things are taken to be either "black" or "white", "left" or "right", for then we can comfortably situate ourselves in one of the two positions, leaving no space for doubt. As a result, the history of Psychology is torn by opposite theories, like Structuralism X Functionalism; Behaviourism X Psychoanalysis; and, more recently, Cognitive-computational theories against Innateness and Cultural theories. The question here is, does it have to be like that? Why can't we integrate different positions into a broader theory? Divisions in science are necessary, because we cannot study everything at the same time, as an ancient Greek philosopher might have felt he could do. But, we cannot forget that divisions are convenient fictions, because a human being lives as a totality and must in the end be considered as such.

I think the findings of this thesis can support a new way of working in Education, leading to further consideration of the differences between a computationalist versus culturalist theories, which are clear, as Bruner (1996) has pointed out.

A computational approach retains old instructive theories of teaching and learning; then, it analyses strategies of problem solving, redescribing them

in computational terms, applying them to human brain, which is supposed to act in the same way as a computer.

The culturalist view, on the other hand, knows that education is part of culture, and questions the functions of education within the culture. After that, it has to ask why education is placed in culture as it is, and, as a result, it analyses the natural resources and constraints imposed on the process of education.

Computationalism is interested in all ways in which information is organised and used, whereas culturalism concentrates on how human beings in cultural communities create and transfer meanings.

According to Bruner (1996), culturalism can benefit from the insights of computationalism, except for the fact that "processes of human meaning making cannot be ruled out" (p.12). This way, culturalism is more involved with intersubjectivity. The possibility of having works done together between humans "...creates shared and negotiable ways of thinking in a group..." (Bruner, 1996, p.23). The consequent externalisation produces a record of our mental efforts, outside us, not in our memory. This can also be shared and modified, creating new models.

On the other hand, it is simply not true that cognitivism can permit us to do without emotions and feelings. In fact, the problem is to know which controls which: emotion or cognition.

This digression is needed to discuss the results of this thesis. It is based on an intersubjective theory of child development, but it also recognises the importance of cognitive factors in that development, although it is not directly addressing them. The results of this thesis, however, point in a direction that is nearer to a culturalist approach.

They could be of use in many different fields, not only as a basis for new psychological research, but also in clinical and educational settings. The first interest to follow in future research would be to investigate even younger infants interacting with each other. The hypothesis of an innate basis for intersubjective exchanges, for which there is evidence from studies of neonatal communication and protoconversation with infants under 3 months of age, leads to the expectation that younger infants might recognise their peers as partners in intersubjectivity. A second research interest would be to observe the evolution of the interactive patterns with older infants and toddlers. This would bring information on the emergence of aggressive behaviours, not registered in this thesis, on peer choices or friendships, and another more complex social behaviours. The use of the Double-TV System of Murray and Trevarthen would be a powerful technique to observe detailed infant-infant interactions.

A clinical and educational application of this thesis would be the work with children with disabilities. If interactions start at early ages, and if infants use imitations and positive emotional expressions to interact with each other, early social intervention could be used to facilitate psychological development, that is, by mixing children with disabilities with non-handicapped ones and permitting them to interact. This would probably help to improve the handicapped child's self-esteem, companionship, and ways of coping with physical and intellectual disabilities, and also permit all the children disabled and non-disabled to develop an accepting attitude in a non-prejudicial environment.

Studying gender and temperament differences is clearly an important additional issue in Education. If girls and boys behave in different ways even as infants, because they have different temperaments and social interests, then an

Educational system should help to develop individual strengths and prevent disadvantage.

It would seem that considerations about intersubjective interactions are fundamental for any Educational planning.

APPENDICES

APPENDIX 1

Letters sent to Subjects's Parents inviting them to take part in the Study

Edinburgh, 12 April 1995

Dear **Mr & Mrs.....**

I'm carrying out research with Professor Colwyn Trevarthen on infants' emotional communication at the Department of Psychology, U. of Edinburgh.

Your name was given to me as a parent who might be willing to let me work with your son (daughter) as a research subject. I am looking for babies from 2 to 9 months of age.

I would like to have an opportunity to talk to you to explain my research project and the equipment used, but basically I will videotape two infants looking at each other through a Television system. Probably, the recordings will not last more than 15-20 minutes.

If you are interested in helping in this research, please phone me at the University: the number is 650 3435. My name is Geraldo Fiamenghi.

Thanks for your attention,
Sincerely,

Geraldo Fiamenghi
Dep. of Psychology
U. of Edinburgh
7 George Square
Edinburgh, EH8 9JZ

APPENDIX 2

Examples of the Application of the Coding System Illustrating the
Different Codes Applied, in each case, to 1 Minute of Interaction

Ellen+Andrew, 6 months, Behavioural Code

Time (s)	Andrew	Ellen	Dur.
3	Eg	Eg; Ae	2
5	Ed	Eg	2
6	Be; Vf	Eg; Xp	1
9	Eg	Eg; Au	3
10	Er	Eg	1
12	El	Eg; Xs; Va	2
13	Eg	Eg; Xs; Va	1
15	Eg	Eg; Xs; Va; Ad	2
16	Eg	Ed	1
17	Eg	Bu; El	1
21	Eg	Eg	4
22	Eg	Er; Vf	1
23	Ed; As	Eg; Lu	1
26	Eg	Ed; As	3
29	Eg	Ed; As	3
30	Eg	Lu; Au	1
32	Eg	Bu; Vs	2
35	Eg	Bu; Vs	3
38	Eg	Bu; Xs	3
42	Eg	Xc; Eg; Lu	4
44	Eg	Eg; Va; Lm; Ga	2
46	Eg; Xs	Br; Be	2
49	Eg	Eg; Lu; Ga	3
50	Er	El; Lu	1
51	Eu	Eu	1
55	Ed	Em	4
57	Eg	Em; Xs; Va	2
58	Eg	Eg; Xs; Va	1
60	Eg	Eg; Xs; Lm; Au	2

Codes:

Ad: hands down; **Ae:** hold ear; **As:** hold straps; **Au:** hands up; **Be:** escape; **Br:** move body to the right; **Bu:** move body up; **Eg:** gaze; **Ed:** look down; **El:** look to the left; **Er:** look to the right; **Eu:** look up; **Ga:** move hand in any direction; **Lm:** legs move left; **Lu:** legs move up; **Va:** vocalisation of attention; **Vd:** vocalisation determined; **Vf:** vocalisation fussy; **Vs:** vocalisation self-centred; **Xp:** pout; **Xs:** smile.

Ellen+Andrew, 6 months, Functional Code

Time	Andrew	Ellen
3	OB	OB; BE
5	WI	OB
6	BE; VO	OB; IR
9	OB	OB; BE
10	WI	OB
12	WI	OB; FR; VO
13	OB	OB; FR; VO
15	OB	OB; FR; VO; BE
16	OB	WI
17	OB	BE; WI
21	OB	OB
22	OB	WI; VO
23	WI; BE	OB; BE
26	OB	WI; BE
29	OB	WI; BE
30	OB	BE; BE
32	OB	BE; VO
35	OB	BE; VO
38	OB	BE; FR
42	OB	FR; OB; BE
44	OB	OB; VO; BE; BE
46	OB; FR	BE; BE
49	OB	OB; BE; BE
50	WI	WI; BE
51	WI	WI
55	WI	WI
57	OB	WI; FR; VO
58	OB	OB; FR; VO
60	OB	OB; FR; BE; BE

Codes:

BE: Body Expressions; **FR:** Friendly; **VO:** Vocalisations; **OB:** Observant; **WI:** Withdrawal;

Ellen+Andrew, 6 months, Negotiatory Code

Time	Andrew	Ellen	Code
3	L	Inv	Inv
5	Non	L	Non
6	Non	Non	Non
9	L	Inv	Inv
10	Non	L	Non
12	Non	Inv	Non
13	L	Inv	Inv
15	L	Inv	Inv
16	L	Non	Non
17	L	Non	Non
21	L	L	L
22	L	Non	Non
23	Non	Inv	Non
26	L	Non	Non
29	L	Non	Non
30	L	Inv	Inv
32	L	Non	Non
35	L	Non	Non
38	L	Inv	Inv
42	L	Inv	Inv
44	L	Inv	Inv
46	Inv	Non	Non
49	L	Inv	Inv
50	Non	Non	Non
51	Non	Non	Non
55	Non	Non	Non
57	L	Non	Non
58	L	Inv	Inv
60	L	Inv	Inv

Codes:

Inv: Invitation; L: Look; Non: Non-interaction

Ellen+Andrew, 6 months, Emotional Code

Time	Andrew	Ellen
3	Curios.	Curios.; Friend.
5	Indiff.	Curios.
6	Irrit.	Curios.; Irrit.
9	Curios.	Curios.; Friend.
10	Indiff.	Curios.
12	Indiff.	Curios.; Friend.
13	Curios.	Curios.; Friend.
15	Curios.	Curios.; Friend.
16	Curios.	Indiff.
17	Curios.	Indiff.
21	Curios.	Curios.
22	Curios.	Indiff.; Irrit.
23	Indiff.	Curios.; Friend.
26	Curios.	Indiff.
29	Curios.	Indiff.
30	Curios.	Friend.
32	Curios.	Indiff.
35	Curios.	Indiff.
38	Curios.	Friend.
42	Curios.	Curios.; Friend.
44	Curios.	Curios.; Friend.
46	Curios.; Friend.	Indiff.
49	Curios.	Curios.; Friend.
50	Indiff.	Indiff.
51	Indiff.	Indiff.
55	Indiff.	Indiff.
57	Curios.	Indiff.; Friend.
58	Curios.	Curios.; Friend.
60	Curios.	Curios.; Friend.

Codes:

Curios. : Curiosity; **Friend.** : Friendliness; **Indiff.** : Indifference

Emily, 9 months, Mirror Study

Time	Behaviour	Expression	Dur.
1	Eg; Xs; Bc	Happy	2
3	Ed; Hd; Mm	Attentive	3
6	Ed; Vo; Hd	Happy	3
8	Eg; Bs	Friendly	5
12	Eg; Xs; Gw	Happy	2
15	Eg; Mm; Aj	Attentive	3
17	Em; Aj	Coy	2
24	Ed; Xs;	Attentive	4
28	Ed; Gt	Happy	3
31	Ef; Gs	Attentive	2
39	Ed; Xp	Attentive	7
44	Eg; Mc	Happy	4
47	Eg; Mc; Xs	Happy	3
50	Eg; Mc; Xs; Xk	Happy	8
55	Eg; Xs; Ga; Xk	Happy	5
58	Eg; Xs; Xk; Gc	Happy	3
68	Eg; Mm;	Attentive	3
72	Eg; Am;	Surprised	5
74	Eg; Gt; Vo	Friendly	3
75	Eg; Mo	Surprised	10
77	Eg; Xs; Vo	Friendly	4
79	Eg; Vo; Aj	Friendly	2
81	Eg; Xs; Ga	Happy	1
93	Eg; Xs; Xh	Happy	2
98	Er; Aj; Xs	Happy	2
101	Er; Aj; Mm	Attentive	2
103	Er	Attentive	12
115	Em; Xs; Am; Vo	Happy	5
120	Bc; Vo	Happy	4

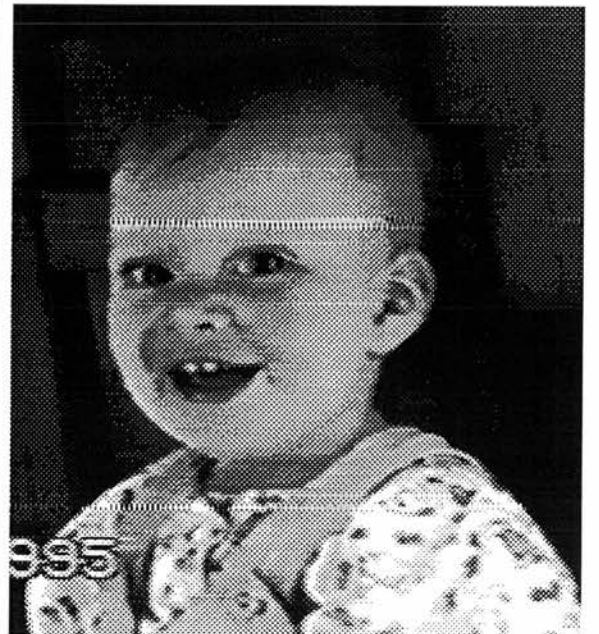
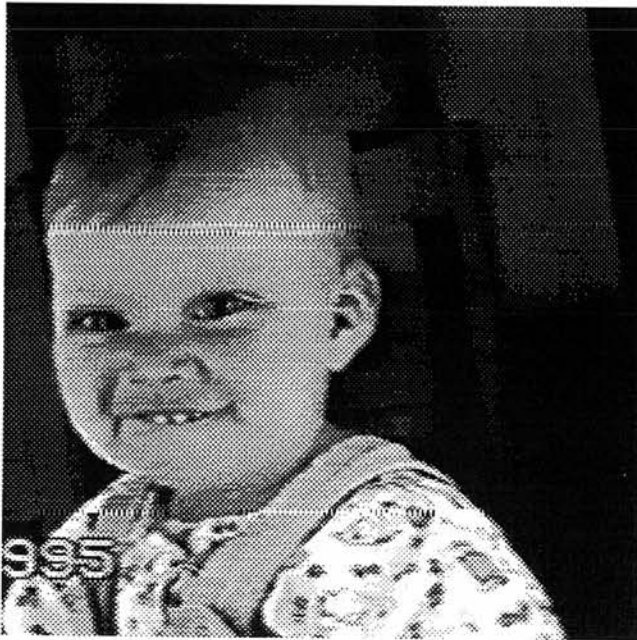
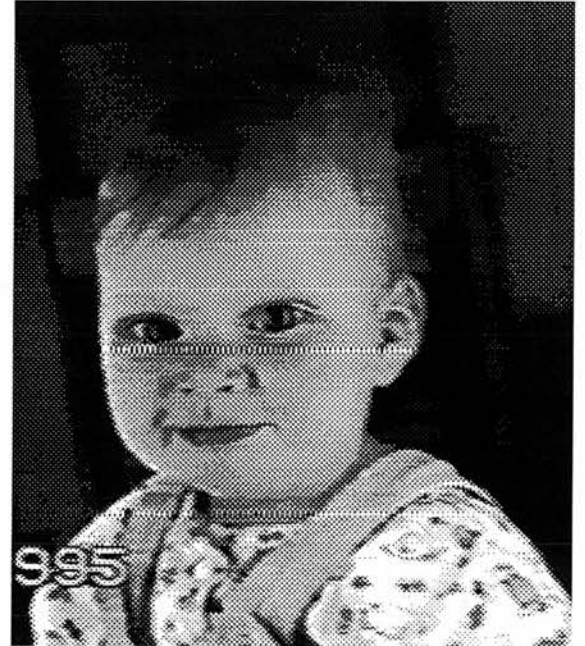
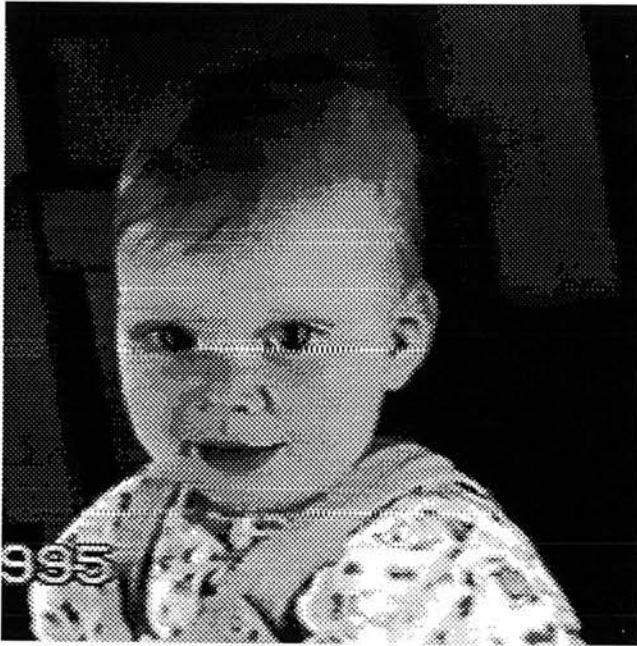
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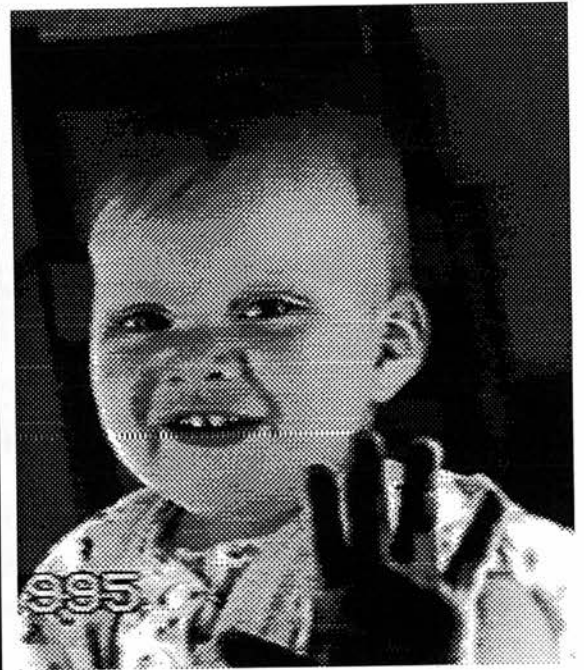
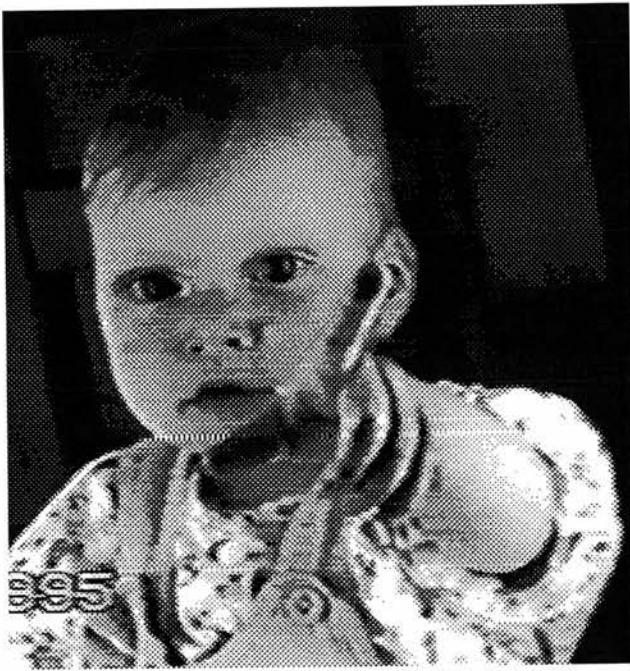
Am: hands in the mouth; **Aj:** hands joined; **Bc:** crawl; **Bs:** stand up; **Ed:** look down; **Eg:** gaze; **Em:** look at mum; **Er:** look at right; **Ga:** move hand; **Gs:** take the socks off; **Gt:** touch the mirror; **Gw:** wave; **Hd:** head moves down; **Vo:** vocalisation; **Mc:** chew; **Mm:** close mouth; **Xk:** send kisses; **Xp:** pout; **Xs:** smile.

APPENDIX 3

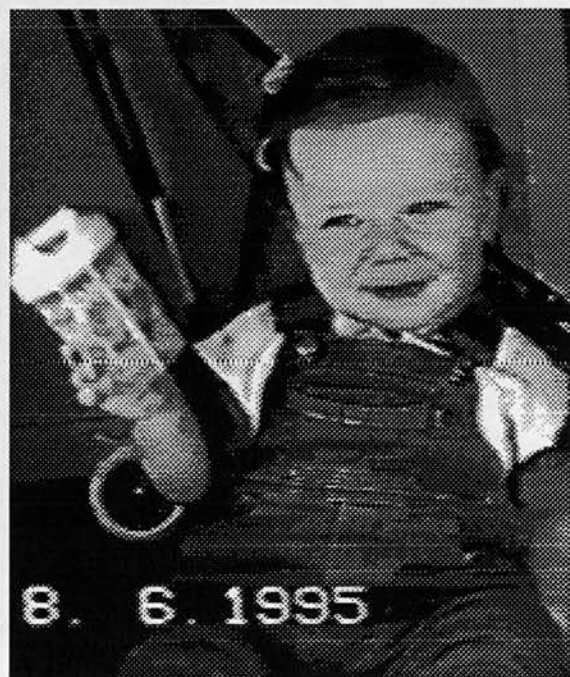
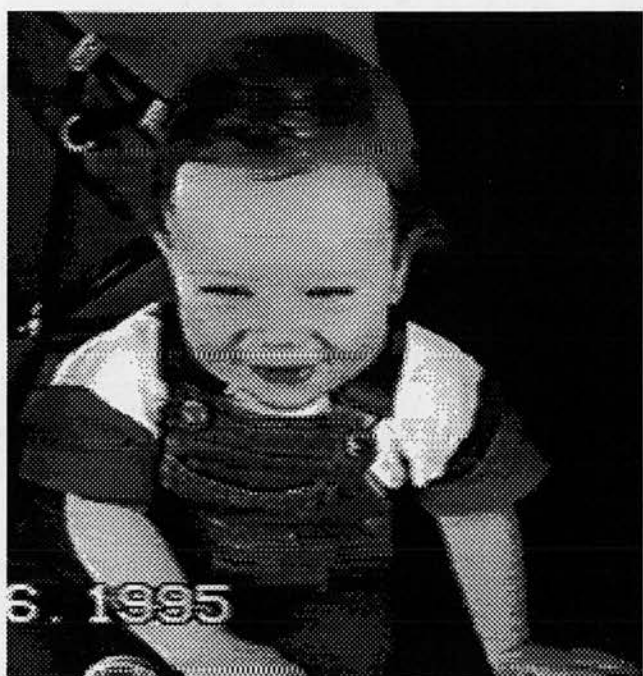
Mirror Interactions

Sequence showing Emily, 9 months, playing with her own image

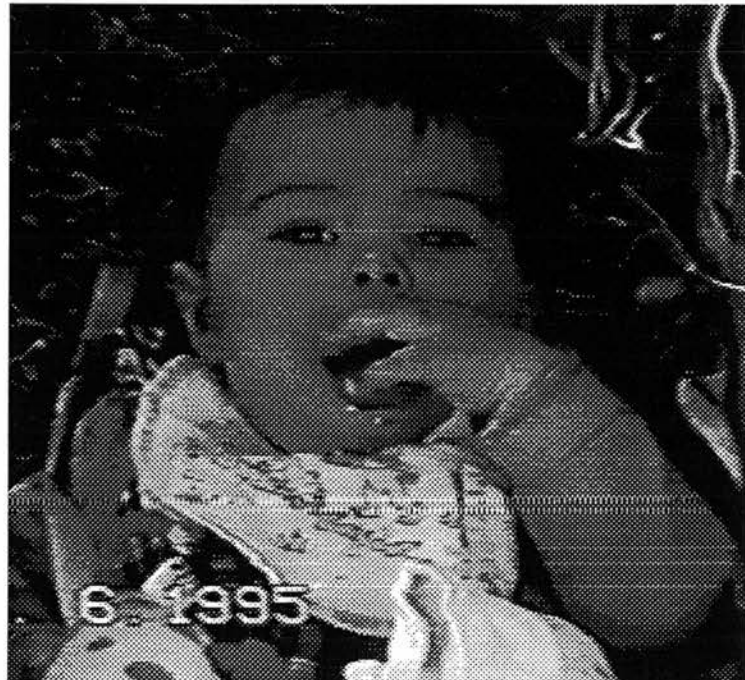


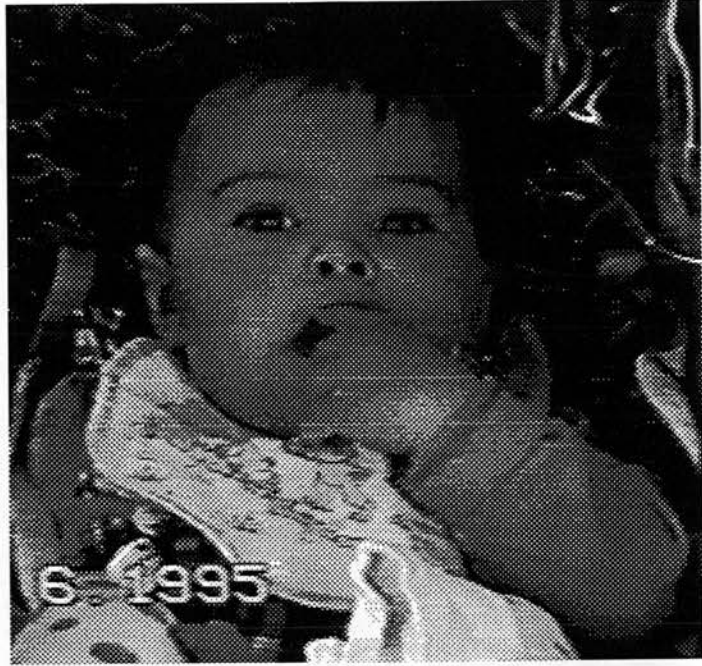


Sequence showing Stuart, 9 months, playing with his own image



Sequence showing Holly, 8 months, protruding her tongue,
recognising and holding it.





APPENDIX 4

Papers published

INTERSUBJECTIVITY AND INFANT-INFANT INTERACTION :
IMITATION AS A WAY OF MAKING CONTACT

Geraldo A. Fiamenghi, Jr.

Catholic University of Campinas-Brazil and University of Edinburgh-Scotland

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INTERSUBJECTIVITY AND INFANT-INFANT INTERACTION : IMITATION AS A WAY OF MAKING CONTACT

Geraldo A. Fiamenghi, Jr.¹

Catholic University of Campinas-Brazil and University of Edinburgh-Scotland

Developmental psychology has traditionally assumed that young infants are born without a capacity for psychological interaction, showing only reflexes in response to the environment triggered by their internal bodily or self-regulatory needs. For example, as a result of Piaget's (1952, 1954, 1962) view of infants' developmental egocentrism, infants under one year were considered incapable of communicating with others of the same age. For many years, Piaget's ideas were prevalent and unchallenged in child developmental research.

Recently, however, these views have been questioned and some researchers have seen the infant's relationship with others as a manifestation of what is called intersubjectivity -- a psychological capacity for recognising and communicating with psychological states of other individuals.

This alternative view, in fact, is not new outside psychology. Actually, the concept of human intersubjectivity has long been the central interest in Philosophy, and in Religion.

For example, such a way of thinking was clearly articulated in Existentialism. Sartre (1970) considered that one's existence could only be 'justified' by the state of existence of the other. Without him or her, I would not exist :

Pour obtenir une vérité quelconque sur moi, il faut que je passe par l'autre. L'autre est indispensable à mon existence. Ainsi, découvrons-nous tout de suite un monde que nous appellerons l'intersubjectivité et c'est dans ce monde que l'homme décide ce qu'il est et ce que sont les autres.

(Sartre, 1970, p. 67)²

Buber (1947) considered the individual in relation to the other in a dialogue. For him, the relationship was "in-between" the one and the other, between two per-

¹ This paper is part of the author's Ph.D. thesis in Psychology at the University of Edinburgh.

² "In order to grasp some truth about myself, it is imperative that I pass by way of the other. The other is vital to my existence. Therewith, we quickly discover a world that we will call intersubjectivity, and it is within this world that man decides who he is and who others are".

sons :

There is a genuine dialogue—no matter whether spoken or silent—where each of the participants really has in mind the other or others in their present and particular being and turns to them with the intention of establishing a living mutual relation between himself and them.

(Buber, 1947, p. 19)

Although this conception of human relations is also present in the works of Bateson (1973), Bruner (1977, 1990), and Stern (1985), among others, this view of human inter-relationship has been stressed most strongly and defined through analysis of mother-infant interactions by Trevarthen (1974, 1984, 1987, 1990, 1993).

Primary intersubjectivity has been defined as the immediate experience of sharing subjective states (Trevarthen, 1979) and secondary intersubjectivity as the search for sharing of experiences about events and things (Trevarthen and Hubley, 1978)

According to Trevarthen (1993), intersubjective encounters become "psychological interactions between selves" (p. 126).

The concept of intersubjectivity is important for the comprehension of infant's development because it helps us to see the new-born as a whole motivated being, not only as a chaotic one, or one made up of reflexes. We are now beginning to understand that the infant has a mental life, that they are particularly well-equipped for social life and so that the infant is eager to become part of it. The infant is born ready for intersubjective exchanges.

We know that empathy of emotions is needed for communication because, emotion is part of the meaning that the situation has for the individual and also part of the message for the others. Empathy in the relationship between mother and infant appears to be the foundation for modulation of relationships to others that will develop afterwards. The first relationship, usually with the mother, is remarkable for the intensity with which it is affectively toned. It surely has a specially emotive and self-regulating quality for the infant (Schore, 1994).

Timing of expressions is an element that serves as a foundation for sympathetic engagement between mothers and infants. Beebe (1982) who has applied the methods of 'conversational analysis' to mother-infant interactions shows that there is a temporal organisation, a "coaction" and turn-taking between mother and infant in their non-verbal communication. A synchrony develops between expressions of mother and child. And, surely, this synchrony is one expression of the affective bond between them. We could say that healthy communication first occurs through affection, that is, through expression of positive emotion. There is indeed a special rewarding quality, a valence, in the affection between infant and mother.

According to Trevarthen, emotions are "intrinsically generated, central, regulatory states of the brain that unify awareness and co-ordinate activity of a coherent, mentally active subject" (Trevarthen, 1993, p. 48), and "emotions also communicate between subjects".

He believes that at 2 months, infants are involved in *protoconversations*, as a first

step towards communicative exchanges. Protolanguage, then, "requires that a child has a clear differentiation of an integrated *self* from the world of *others*" (Trevarthen, 1987, p. 182). This view agrees with Stern's point that "preverbal senses of self start to form at birth, if not before" (1985, p. 5).

The study of imitation is a method of demonstrating infants' ability to involve themselves in intersubjective interaction, because imitation is a direct indicator of sympathy between persons. It is now proven that imitation exists from birth and many researchers are exploring all ranges of mother-infant communication and infant's imitation (Maratos, 1973, 1979; Meltzoff & Moore, 1989; Nadel & Fontaine, 1989; Nadel & Pez . 1993; Vinter, 1985; etc.).

Peer imitation is a new area for research that is proving the importance of a shift of interest to intersubjectivity (for example, Hanna & Meltzoff, 1993; Patrick & Richman, 1985). In this situation, infants are involved in relationships with strangers who are, moreover, no more developed, skilled or sophisticated than themselves.

As Hanna and Meltzoff (1993) suggest, "mutual imitation between two partners is a principal mechanism for interpersonal communication in infancy, before language. Toddlers use imitation as basic way to interact and develop social and communicative ties with one another" (p. 701).

Other authors are studying playing and teasing as a means by which both infants and their parents negotiate affective relationships (Nakano, 1994, 1995; Reddy, 1991). Nakano considers benign teasing a way of creating mutual amusement between mother and infant. He says that teasing is a very good example of intersubjectivity and that it contributes to the development of communication.

All of the above studies have brought new insights into the field of human development and emotion.

We have chosen infant-infant interaction as a promising research topic for the study of first intersubjective encounters.

Very few researchers have concerned themselves with infant-infant interaction. The studies that we have reviewed do not mention the quality of the intersubjective exchanges. They were more interested in the quantitative measurement of the behaviour of each individual (which is very curious, if you think that what should be considered is the dyad, not the individual).

Although those studies were not primarily concerned with interaction, they did showed the presence of some degree of involvement between the infants. For example, it has been observed that new-borns can be distressed and cry when listening to other babies' crying (Simner, 1971; Sagi & Hoffman, 1976; Martin & Clark, 1982). Others have analysed the relation between pairs of infants and toys (Vandell, Wilson & Buchanan, 1980); recorded the reaction to distress of peers (Hay, Nash & Pedersen, 1981); and compared the interaction between mothers and that between peers (Adamson & Bakeman, 1985; Fogel, 1979).

In our own research, with infants of five months and older, who were seated in their push-chairs facing each other, out of contact with their mothers and without toys,

we found many interesting interactions, that demonstrate the intersubjective characteristic of awareness present in human beings from early infancy.

The infants used imitation to interact, mainly imitating partial body actions (like kicking, for example), and it seems that this is a way to call, retain the other's attention and resume interactions. It is also very frequently the cause of synchrony between their behaviours. We prefer to call this mutual engagement attunement (Stern et al, 1985) as this term emphasises the intersubjective nature of their understanding. For example, both infants at 22 weeks are looking at each other and both simultaneously move their bodies to their right, then to their left, also lifting their legs. Looking at their movement, we can see they are timed to synchronise with each other; there is a precise attunement in their actions.

If we could summarise the uses of imitation in infant-infant communication (based in our research), the result would be:

1. Pairs of infants use imitation as a means of communicating.

They can start a "conversation of movements" through imitative behaviour, and, as the interaction progresses, they take turns and we can observe a "conversation" occurring in the form of attuned body movements.

Take, for example, two 8-month-old infants, a boy and a girl. They have never met before and are seated on their push-chairs, facing each other. Suddenly, the boy starts to kick and the girl imitates him immediately. He kicks back and she does the same, but vocalises, smiles, points at him, who is absolutely stunned by the presence of another infant in front of him and kicks back, vocalising to her.

2. They synchronise their behaviours. As stated above, we will call this sympathetic attunement. They make the same movements with their bodies at the same time. In the above example, in one minute there were 2 imitations and 5 attunements.

3. Imitation is also used to *keep the movement-conversation going*. Consider the case of two 9-month-old infants, a girl and a boy. He kicks and holds his leg up, and she imitates him, but not with the exactly matching body movements. First, because she is not so "athletic" as he is (he can put his legs in a higher position than she can do) and second, because as he kicks, he vocalises in a long and loud way ("Tarzan-like"), while she smiles. As his attention shifts to other things, such as investigating his push-chair screws, she tries to call his attention back, kicking and moving her legs up. She succeeds, because he imitates her and emits his "Tarzan-like" call again.

4. Imitation may serve to *express recognition and sympathy*. For example, two 9-month-old infants, a boy and a girl were interacting. He looks at her, vocalises an "a-haa" sound and waves his hand, jumping in his push-chair. She smiles at him and waves back, vocalising a "uu" sound. He laughs at her and waves back again.

5. Imitation may also be used to *tease* or provoke the other. A 9-month-old boy keeps shaking a toy, holding it in front of a girl at the same age. She imitates his hand movements, and vocalises "uu", pointing as well. As she tries to reach it, he jumps and shakes the toy again, evidently finding pleasure in provoking her efforts. She also seems to be pleased, because she keeps smiling and vocalising, showing no distress that she cannot get the toy.

Imitation, then, has many different functions when infants of the same age are

interacting.

Interactions between infants were found in our study at 5 months.

In general, babies would gaze at each other, showing interest, then smile, kick, vocalise or move parts of the body. This was called an invitation for interaction, and it may or may not excite an answer -- the other infant gazes back, moves the body, smiles, kicks, or vocalises, in response. For instance, a five-month-old girl gazes at a same age boy, smiles, moves her legs up and down and vocalises. The boy gazes back very attentively, and laughs, spitting. Of course, in many cases, the invitation was not followed by an interaction. The other infant would only gaze back. An explanation for the amount of invitation behaviours that were not followed by an interaction is offered below.

We observe that, at one level there is no difference between infant-adult communication and infant-infant communication, although infants with infants interact less than infants with adults. It seems that the interactions follow certain of the same patterns. There is comparable mutual attunement, synchronised timing of behaviours, turn-taking and empathy of feelings. However, adults are certainly more efficient in creating and maintaining topics³ (Nakano, 1995). Adults will persistently call the infant's attention, inviting with smiles and vocalisations and trying to keep his or her gaze, adopting new strategies if the infant turns away. In fact, infants under 6 months of age keep their attention on one object for a very little time. This is also true in their interactions with other infants. When confronted by adults, infants are encouraged to keep their attention to the adult by the adult's efforts. Otherwise, the infant can easily lose interest and shift attention to other things.

This belief in adults' more developed ability to create topics in communication with infants does not mean that infants are not able to interact. Infants do interact with other infants and, although their attention shifts very frequently, they can show intense interest in another infant from moment to moment.

Concluding, then, we observe imitation to be a very important means of initiating and maintaining interactions between young infants.

Interaction occurs in short (less than 5 seconds) episodes, probably because infant's attention is intrinsically unstable. Sometimes, as a result, an invitation for interaction may not be answered, but the interaction can be resumed when one of them calls back the other's attention.

Intersubjectivity, the sharing of personal expressive states, permeates all these interactive situations, setting the scene for the participants to share and learn meanings. Intersubjective engagement, allows the infants to perceive one another as human beings who try to make contact and share experiences.

Even infants under one year of age have primary experiences to share. They do this by showing body movements, laughing, making funny faces and teasing. This is a fundamental part of being human.

³ Topic, here, is used in the sense of an object or action of shared interest. For example, the mother can call the infant's attention by showing him or her a toy and shaking it in front of his or her eyes, smiling and vocalising.

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Speaker 6:

Interaction Between Infants: Understanding The Innate Basis for Intersubjectivity and Emotional Expression

Geraldo Fiamenghi Jr., Department of Psychology, The University of Edinburgh

This research is aimed to clarify the processes of infant intersubjectivity by analysing interactions between same age infants. Although the importance of research on infant-to-infant emotional expression and communication is obvious, there are few studies investigating how young infants communicate. Published studies (Fogel, 1979; Hanna & Meltzoff, 1993; Hay, Nash & Pedersen, 1983; Jacobson, 1981; Maratos, 1979; Mueller & Vandell, 1979; Sagei & Hoffman, 1976) indicate that emotions can be shared between infants in social interactions. Even newborns can interact by crying adjusted to the other's cries. We set out to test the capacity of infants to support protoconversational efforts of their age mates. Pairs of infants, 4 girls and 8 boys, were videotaped at 20-25 weeks, 31-35 weeks, 36-40 weeks in same age dyads, seated on push-chairs facing each other. Micro-analysis of the first 2 minutes of interaction has been completed. Four main categories of interactive behaviour were identified: Interacting, Inviting, Looking and Imitating. Statistical analysis of these will be reported.

Fogel, A. (1979) Peer- vs. mother-directed behaviour in 1- to 3-month-old infants. *Infant Behaviour and Development*, 2: 215-226.

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Stress and Adaptation from Molecules to Man

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ABSTRACTS



***International Congress of Stress,
an interdisciplinary discussion commemorating
the 90th birth anniversary of Hans Selye***

INTERPERSONAL STRESS IN INFANCY: REGULATING COMPANIONSHIP

TREVARTHEN, C. and FLAMENGHIL G. A. Jr.

Department of Psychology, The University of Edinburgh, Scotland, UK.

Some signs of stress in infancy are a direct result of failed communication. These indicate uniquely human requirements for self/other regulation. Infants are born able to engage in dialogic 'protoconversations' and games with others that are not related in any direct way to regulation of physiological state. This innate 'inter-subjectivity' originates in motives for interpersonal interaction that lead to a place in the cultural world. At one year joint attention serves learning of language and cultural skills.

When faced with the mother showing a 'stiff face', or a video replay image of her speaking, a 2-month-old tries to interact, but withdraws when no contingent response is obtained. The infant may show acute distress. A mother's postnatal depression may profoundly affect the quality of interaction with her baby. Problems in cognition, learning and social adaptation may be detected as far as 6 years after this negative experience, more conspicuously in boys.

Six-month-olds can engage in inter-subjective contact with age-mates, using imitative, interactive and inviting behaviours. These are emotionally toned, expressing curiosity and friendliness if the other infant reacts positively. On the other hand, the infant can react negatively, with indifference and irritation, if no answer is received. In extreme situations a rejected infant may cry and avoid. However, a common response to frustration when the other infant avoids contact is indifference, or shift of attention elsewhere.

More research is needed to understand how infants cope with difficult interpersonal contacts, and to identify what they are seeking. Early interactions may provide templates for further patterns of communication. Failure to obtain contact with significant others, and the resulting stress, can influence future transactions in interpersonal life. There is evidence that emotions regulate brain activity and brain development. However, mechanisms for defence or regulation, which will be more effective for some individuals than others, can reduce intersubjective stress.

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