Effects of early Tactile Stimulation on low birthweight Infants - 2-years follow-up study

by

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"Man has created new worlds - of language, of music, of poetry, of science, and the most important of these is the world of the moral demands, for equality, for freedom, and for helping the weak"

....Sir Karl Popper: "The Open Society and Its Enemies", Vol. 1, 5th Ed., p. 65, 1966.

"The erroneous belief that science eventually leads to the certainty of a definitive explanation carries with it the implication that it is a grave scientific misdemeanor to have published some hypothesis that eventually is falsified. As a consequence scientists have often been loath to admit the falsification of such an hypothesis. Whereas according to Popper, falsification in whole or in part is the anticipated fate of all hypotheses and we should even rejoice in the falsification of an hypothesis that we have cherished as our brain-child. One is thereby relieved from fears and remorse, and science becomes an exhilarating adventure where imagination and vision lead to conceptual developments transcending in generality and range the experimental evidence"...........

...Sir John Eccles (writing of Sir Karl Popper): "Facing Reality", p. 107.

Dedication

To my beloved son Carlos Mauricio
who had premature death, and
to all mothers who experienced
"anticipatory grief".

To all premature babies whose struggle
for survival has enabled the
study to be accomplished.

Abstract

Three experiments investigated the effects of tactile stimulation on a large sample of infants (N = 115). The pilot experiment used full-term babies (n = 13). It compared the effects of Rice Infant Sensorimoter Stimulation (which involves stroking together with other kinds of stimulation) with various controls. At three months the R.I.S.S. babies had higher scores on the Bayley Developmental Scale.

In the main experiment, only stroking (no handling) was used as stimulation for 10-15 minutes, twice daily for 14-21 days employed by the investigator. Birthweight was in the range 760g to 2,200 kg. Three hospitals were used. In the first one, experimental babies (n = 6) gained more weight (by day 21) and were bottle fed and moved to the cot earlier than controls (n = 6).

In hospitals 2 and 3, fifty-four babies were treated as coming from the same population (justified by statistical analysis). Some of the findings are that, as compared with controls, treated babies had less weight loss in the first week and higher gain at day 21, and scored higher on sucking and hand grasp. There was some evidence that the gains were greatest if stimulation was started before day 3. At 40 weeks the treated babies scored higher on general measures, but particularly several items of the Dubowitz Assessment Scale. Compared with full-term untreated infants of the same age (n = 10), at 40 weeks the pre-term treated infants had poorer posture, but better auditory orientation and alertness and fewer startles.

At 12 months, treated AGA infants scored higher on the Bayley Development Scale (MDI) than untreated AGA infants (blind). Compared with full-term (n = 6) untreated infants of the same age, the preterm AGA untreated and the preterm SGA treated infants had a poorer MDI score (adjusted aged).

A final complementary study used a modified stroking technique (n = 20). 'Blind' assessments showed that treated infants had less weight loss in the first week and higher gain at day-21, and scored higher on sucking and hand grasp. They also showed significantly higher scores on posture, leg traction, body movement, rooting, walking, auditory orientation and less irritability. At 6 months, follow-up treated infants scored higher on the Bayley Development Scale (MDI).

Concurrent and immediately subsequent reactions to the stimulation showed that treated infants changed their state and showed signs of pleasure (main and complementary studies).

The two experiments together provide some evidence that tactile stimulation on its own has beneficial physical, neurological, neuro-behavioural effects.

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1.0 INTRODUCTION

Since the 1960s, there has been increasing interest amongst Psychologists, Psychiatrists, and Paediatricians regarding scientific investigations into the adverse effects of perinatal insult on later behavioural and physical development. Of special concern are premature babies who characteristically have low-birthweights. Low-birthweight infants constitute a set who are "at-risk"; i.e., particular groups within the set are likely to contain individuals, up to the total membership of a group, who will fail to thrive.

Low-birthweight may be attributed to:

(i) poor nutrition of the mother

or, (ii) the biological condition of the mother

or, (iii) a combination of (i) and (ii).

Socio-economic status (SES) helps to differentiate between these categories; Stratton (1977) declares that SES is the most reliable predictor of development progress in the child. The importance of this is clear for the majority of developing countries which cannot provide adequate facilities and/or conditions for encouraging the development of their disadvantaged children. During pregnancy a foetus may be receiving inadequate sustenance because of biological disturbance or imbalance of the mother's body.

Whatever the reasons from within (i) to (iii), inclusive, infants born prematurely are considered to be at-risk by both professional and familial opinion (Caputo & Mandel, 1970); however, the effects of postnatal environment remain controversial. Particularly controversial issues are whether, or not, adverse effects of low-birthweight (LBW) may be ameliorated by favourable interaction with the environment and its converse (Wiener, Rider, Oppel, Fischer and Harper, 1965; Werner, Bierman and French, 1971; Drillien, 1964). Nevertheless there is considerable agreement in regarding LBW infants as a set, the behavioural development of the individuals being most at-risk and, ipso facto, most in need of attentive fostering (Williams and Salapatek, 1973).

Coincidence of biological vulnerability with subsequently poor social circumstances have, in the case of LBW babies, been shown to interact with particularly disastrous effects on later intellectual functioning (Birch, Richardson, David, Horobin & Illsley, 1970); Braine, Heimer, Wortis & Freedman, 1966; Willerman, Broman & Fiedler, 1971; Williams & Scarr-Salapatek, 1971; Scarr-Salapatek & Williams, 1973; Neligan et al., 1976). More complex still are the questions of deviant behaviour; the last two decades have seen increasing preoccupation with standards of antenatal and postnatal care, but there remains both disagreement in definition and lack of knowledge regarding the prevention of deviant behaviour in groups under risk of failure to thrive. There is manifestly a need for counselling parents on how to care for their very tiny babies, especially if they have to be separated from them in the early stages of life. Stratton (1977) has argued for a balance between the medical objectives of producing healthy mothers and babies, on the one hand, and an awareness of psychosocial influences, on the other.

The work of the last two decades suggests that many infants whose birth-weights are 2,500 gm. or less, suffer significantly more handicaps in neurological, social, mental and motor development and functioning than full-term infants (Drillien, 1958, 1961, 1970; Scarr-Salapatek & Williams, 1973). However, Beckwith (1976) has pointed out that most of the early studies indicate considerable progress amongst children whose birth-weights were in the region below 1,500 gm. at birth; where there were fewer initial disabilities, there was a tendency toward higher frequencies of IQ above 100. This last finding enhances rather than obviates the need to develop intervention techniques for primary preventioon of a developmental deficit (Korner, 1981) in children with low-birthweight.

This thesis is concerned with two main issues. Firstly, the development and refining of "stroking"* techniques, particularly suitable for preterm babies and, secondly, with the efficacy of these techniques since they have been designed to encourage the developmental potential of preterm infants, irrespective of the cause(s) of their prematurity. In the words of Korner, they are stimulation techniques where the "goal of intervention is strictly one of compensating for an experiential deficit". A later, albeit incompleted objective, was to commence a system of observations, with appropriate methodology, of the beneficial consequences to preterm babies of encouraging parents and nursing staff to acquire skill in these techniques.

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* Stroke. Substantive. 1631. (from STROKE, verb). A stroking movement of the hand, especially (archaic) for purpose of healing .... Shorter Oxford English Dictionary, 1968 ed.

2.0 PRE-TERM BABIES

2.1 Reproductive Risk

Traditionally, the regularly ascribed associations between adverse obstetric states and a variety of intellectual and emotional problems encountered in school-age children have been treated in terms of a "continuum of reproductive casualty".

Studies from the 1950s and early 1960s report that brain damage occurring in the perinatal period was later likely to be a source of neurological disorder. Pasamanick and Knoblock (1960) compared the obstetric histories of school children with behavioural disorders, to those without, and found three times as many premature births and 25-50% more pregnancy complications in the first group. Drillien (1964) had similar findings; of 514 babies born between 1953 and 1960, the indication was of severe to moderate handicap with decreasing birthweight.

However, studies of children suffering perinatal insult in the later 1960s and 1970s claimed to show a striking reduction in serious handicaps. Several studies (Stewart, 1974; Davies and Tizard, 1975; Neligan, 1974) suggested a decrease in serious handicaps associated with low-birthweight. There is thus little consensus towards establishing an association between perinatal damage and the persistence of behavioural deviancy and learning disabilities; moreover, some babies who do suffer perinatal damage, and whose development is slowed during their early years, seem to recover, sometimes completely, whilst others do not. In addition to this volume of confusing evidence, there are cases of learning and effect which cannot be ascribed to any specific birth event. Clearly the assembly of evidence is uncertain and contradictory, and renders dubious the predictive value of "continuum casualty" in seeing child development as a chain of cause and effect.

Sameroff & Chandler (1975) instead proposed a model which takes into account both the nature of the maintaining environment and the individual characteristics of the child, in a circuitious process, and argued for a "continuum of caretaker casualty". This proposal implies belief in a principle of plasticity of the central nervous system, argued recently by Isaacson (1976).

The small-for-gestational-age (SGA) babies would appear to constitute an identifiable problem. More recent studies (Beckwith, 1976; Neligan, G.A., 1974) of babies who have experienced adverse obstetric circumstances, have shown a decrease in handicap. However, other work of the same period (Dubowitz, 1977; Neligan et al., 1976; Brazelton, 1976) has produced evidence that SCA babies have different problems at birth, have subtle but substantial differences of behaviour, and are most at risk of permanent retardation.

The lethargy and diminished response to stimulation of the SGA babies reduces a child's mutual value as a stimulus, with corresponding incapacity to elicit synchronic transactions from caretakers who may be either nutritionally depleted, or overstressed, or both. The parents may perceive their children to be difficult babies. Such characteristics of the SGA babies could be attributed to either structural damage caused by pre- or by postnatal malnutrition to the child's central nervous system, or to a more transient effect of the nutritional condition of the child (Rossetti Ferreira, 1978). In a longitudinal study, Chavez, Martinez & Yaschine (1974) showed that nutritional variables have a pervasive effect on the interactions established between child and environment. Als, et al. (1976) found that SGA infants had poor tone, low activity levels, poor hand-to-mouth coordination, poor responsiveness, unfocused and unmodulated interactions compared with full-sized infants. A review by Caesar and Akiyama (1970) had shown a pattern for the neonatal characteristics which differentiate the SGA infant from the full-sized infant; it is concerned with reflexive behaviours and general responsiveness. Michaelis, Schulte & Nolte (1970), for example, found differences in standing and stepping responses, Moro and asymetric tonic neck reflexes between the SGA and full-sized infants.

At this stage an apparent paradox appears which requires elucidation, and which certainly militates against any linear, causal interpretation of the many phenomena with their interlinked variables. A poor environment which is inadequate for the necessities of an infant, who may be unresponsive, lethargic or hyperactive, may be found to amplify, reduce, or override the effects of adverse obstetric states experienced by that infant. This leads to the presumption that the shift from:-

(i) a continuum of reproductive casualty to a continuum of caretaker casualty,

(ii) plasticity to nonplasticity,

(iii) old to new approaches regarding the interaction between child and caretaker,

may make hopeful the future of "at-risk" children.

2.2 Very low and low birthweight babies

Very LBW and LBW babies represent groups whose behavioural development are most at risk and most in need of fostering. Their biological vulnerability and their subsequently poor social circumstances have been shown to interact with particularly disastrous effects upon later intellectual functioning (Birch, Richardson, David, Horobin & Illsley; Braine, Heimer, Wortis & Friedman; Willerman, Broman & Fiedler; Williams & Scarr-Salapatek; Scarr-Salapatek & Williams; all op. cit.).

Any low-birthweight babies include those whose birthweights are:-

(i) small-for-their-gestational age (SGA),

and,(ii) appropriate-for-their-gestational age (AGA).

Although subdivision of babies according to their birthweights has generally been agreed as effective in isolating babies at risk, some authorities (Neligan et al., 1976; Dubowitz, 1977) have argued that further subdivision appropriate to gestational age will improve the effectiveness of "risk" classification. Babies with birthweights retarded in relation to gestational age may have been malnourished in utero, either because of poor maternal diet, or because of placental disfunction. In recent years, interest has increased in differentiation between SGA and AGA by attempting to determine the gestational age (GA) of babies more precisely.

The differences between the SGA and AGA have attracted much attention. The SGA group encounter problems such as Hypoglycaemia, Pulmonary Haemorrhage, Polycythemia, and Hyperirritability (Sjöstedt, Engleson and Rooth, 1958; Gruenwald, 1963, 1968; Silverman & Sinclair, 1966; Drillien, 1968, and others), which the AGA group do not have. There is also evidence that there are subtle yet substantial neuro-behavioural differences (Brazelton, 1976; Neligan et al., 1976; Dubowitz, 1977). SGA babies furthermore, are likely to be most at risk of permanent retardation, and there is evidence that they perform less well in school-age assessment.

2.3 Prematurity

The classification of preterm births has often been done on the basis of birthweight and/or gestational age (Keller, 1981).

In epidemiological studies (Berendes, 1963) birthweight has most often been used as the criterion of prematurity. One reason for this is that birthweight is more accurately reported than is gestational age (Keller, 1981).

Traditionally prematurity has been reported in terms of birthweight with infants weighing less than 2500 gm. However, although approximately accurate, this standard is misleading because it encompasses small-for-date term infants but not large-for-date infants who are, in fact, actually premature. Thus, comparison of survival data was difficult to interpret (Werthmann, Jr., 1981).

Battaglia and Lubchenco (1967) defined the word "preterm" to distinguish any infant born before 37 completed gestational weeks dating from the onset of the last menses. The relationship between prematurity and survival has changed however as a consequence of the medical advances of the last decade, to 24-26 weeks gestation. What is clear, is that the shorter the infant's period of gestation, the greater the risk status of the infant (Lubchenco, 1970).
Around 7% (Dear, 1982) of UK births are LBW babies. Survival of such babies has increased with the rapid development in Neonatalogy in the 1960s and 1970s; however, there is still a precarious interface between intact survival and survival with handicaps (Werthmann, Jr., op. cit.). The work of Dubowitz & Dubowitz (1977) contributes enormously to the accuracy of the assessment of gestational age since it combines neurological and external (superficial) criteria.

An extremely important question is to identify the factors which give rise to a high incidence of low birthweights. Many such factors have been investigated intensively; they include mother's race, age, parity, previous pregnancy history, family income and education, cigarette smoking, weight gain during pregnancy, and pregnancy weight (Abramowicz & Kass, 1966a, 1966b, 1966c, 1966d, in Keller, 1981). The complex inter-relationships between the factors of this incomplete list makes it extremely difficult to evaluate their independent importance in predicting prematurity.

2.4 Separation and the Special Care Baby Unit

The separation of the infant from the mother, which is the practice in most of the high-risk hospital nurseries, is challenging research at the present time. Low-birthweight (LBW) infants are separated from their mothers after birth. They need special care to keep them warm, to protect them from infection, and to be given an atmosphere with increased humidity and oxygen, if required. There are consequences of behavioural disturbances with these arrangements, and the area remains controversial.

Behavioural disturbances may be shortlived (Rutter, 1972), or longlasting (Douglas, 1975) as a consequence of early separation; this has produced:

(i) greater care in formulating separation policies,

and, (ii) making arrangements within the hospitals to enable mothers to "room-in".

Where difficulties arise in (ii), it is not usually as a consequence of the facilities, but of the "change" in attitude required of the mother towards acceptance of the notion of having had a premature baby; emotions of fear, anger, and guilt are quite common.

Richards (1978) has pointed out that whilst the evidence is far from complete and inconclusive that partial or complete separation immediately after birth has consequences for the parent-child relationship, and for the development of the child, it cannot be stated with any confidence that early separation has no import. A reasonable view is thus where even a mild degree of caution suggests itself, separation should be reduced to the barest minimum compatible with good physical care of newborns and with early diagnoses of the cases of those infants requiring early psycho-physiological intervention. That a correct balance is normally struck between physiological and psychological care in the SCBUs is far from established, or even that psychological care exists at all in the UK. Werthmann, Jr. (1981) has stated that adequate in-depth knowledge and training for physicians and nurses who are responsible for the provision of care to premature infants in such settings, is an obvious necessity but difficult to achieve. The cases of complex, interrelated and frequently simultaneous medical problems which occur, illustrate the precarious balance between intact survival and survival with handicaps.

Within this medical milieu, the doctors, nurses, parents and infants interrelate. Needless to say this is often done under emotional strain and with time constraints induced by episodically short nurse/doctor/patient ratios. Only in the past few years has the field of neonatalogy begun to concentrate on evolving a technique for evaluating the effect of these medical constraints on the optimum psychological development of the preterm infant. The commonly held view is still that premature babies do not yet need primary psychological care; neonatal psychologists are generally regarded as superfluous in SCBUs, or even undesirable.

A psychological point which appears to be of importance in this context is that several studies (Klaus et al., 1972; Kennell et al., 1974) showed that extra-contact mothers cuddled and held their babies more, and at 42-months age these infants had significantly higher IQs (Klaus and Kennell, 1976) than the control groups. Parents need to be encouraged to touch, to handle, to cuddle, to stroke their babies and to sense the responsibility towards caring for them in order to reduce or even avoid altogether a feeling of "not belonging"; this latter often appears amongst the mothers of LBW infants. Some mothers attribute separation at birth and type of delivery as the causes of this feeling.

2.5 Parental reactions to Preterm Infants

Some work has been done to establish the feelings of failure and guilt experienced by fathers in not having produced "normal babies", (Jeffcoate, Humphrey and Lloyd, 1979, 1979). However there are several studies which comment on the mothers' feelings of failure and guilt (Beckwith, 1976, Blake, Stewart & Turcan, 1975; Kramer & Pierpont, 1976; Kaplan & Mason, 1960; Jeffcoate, Humphrey and Lloyd, 1979, 1979). Kramer & Pierpont has suggested that, quite apart from feelings of inadequacy, the mother is emotionally affected by the shortness of the pregnancy and is unable to perceive the infant as being complete. Coulonjou (1983) has suggested that communication of a mother with her foetus, by talking and touching her stomach, is likely to calm her, even if the conditions of unwanted child, guilt, neurotic anxiety and maternal history of psychological trauma are present. Mason (1963) found that he could predict a mother's success in meeting her premature baby's physical and emotional needs from interviews conducted during the lying-in period. It therefore seems that the mother's expressed attitudes and feelings are directly related to her relationship with her unborn infant.

According to Caplan, Mason and Kaplan (1965) four psychological tasks accompany a preterm birth:-

(i) Anticipatory grief in that the mother hopes that her baby will survive but simultaneously prepares for its death, thereby causing withdrawal from the relationship established during pregnancy.

(ii) Acknowledgement of a feeling of failure in not having delivered a normal full-term infant.

(iii) Believing that the infant will survive, the mother considers starting a relationship again with her baby.

(iv) Coming to understand the needs of preterm infants, the characteristics of their behaviour and growth patterns, including the temporary nature of the latter.

Lamb (1983) has recently been emphasising that traditional nuclear family patterns, in which a woman provided nearly exclusive child-care and a man provided emotional and economic support, are decreasing as a consequence of increase in the number of single parents, employed mothers, extra-familial child-care facilities, and increased paternal participation in child care. Under such societal conditions, it is quite likely that the important direct role on the child's development and that of his family will diminish; this may well be true for that of the mother also. Herzog (1983) has pointed out furthermore, that children deprived of a male parent or appropriate surrogate at two-years of age manifest "father-hunger", an effective object relations state with apparently long-term consequences.

2.6 Effects of the Infant

Premature infants are typically found to be "less well organised" than full-term babies. LBW babies may be irritable, becoming stressed when picked up (Drillien, 1973). SGA babies have been found to have poor coordination, poor responsiveness and low activity levels (Als, et al., 1976). The importance of assessment of gestation age (GA) is already well established (Dubowitz & Dubowitz, 1977). If the infant is preterm and SGA, then he/she is likely to have even more complications, poor co-ordination, and low activity.

Bell (1968), Korner (1974), and Osofsky (1979) have all been showing that infants have effects on maternal behaviour. Bowlby (1958) and Ainsworth (1972) have emphasised the instinctive responses which comprise the attachment process, namely sucking, clinging, following, crying and smiling. Bowlby's thesis is that, as with the young of other species, there matures in the early months of life of the human infant, a nicely balanced complex of instinctive responses, the function of which is to ensure that he/she obtains parental care sufficient for survival; to this end, the infant's equipment includes both responses which promote close proximity to a parent and those which evoke parental activity. Thus Ramey, Zesking and Hunter (1981) assert that the premature child is an atypical child so far as his/her response repertoire is concerned, and may well be hindered in displaying the kinds of instinctive responses which will secure an effective attachment to the primary caregiver.

Extrapolating from Piaget's theory (1952), Ramey op. cit. have pointed out that any set of conditions which reduce either an infant's active involvement with the physical environment generally, or the range of those experiences, should tend to slow and perhaps hinder a normal course of development. Hence a preterm infant's relatively restricted response repertoire, together with the environmental constraint due to being in an incubator, should tend towards reduced opportunity for exercising sensorimotor schemata; this, for Piaget, is a period during which a child's conception of the world occurs as a direct result of manipulation of objects in the physical world, concomitant sensory feedback occurring as a consequence of the infant-environment transactions. The co-ordinated, visual-motor exploration may have a role as a precursor of infant-object permanence concepts. Consequentially a preterm baby with poor co-ordination and low activity would be expected to delay such an exploration, and hence retard the acquisition (internalisation) of the object permanence concept which is important for his development. It follows that there is need for such early intervention programmes to compensate for such deficiences.

As mentioned earlier, the SGA baby is one who may have suffered malnutrition in the uterus (Chase, 1976). Brazelton, (1976); Als et al. (1976) have showed marked differences in reflex behaviour between the SGA and their peer full-term babies in comparing SGA full-term with full-weight, full-term infants. This set of conditions could possibly be extrapolated for preterm and SGA babies which accumulate two series of deficiencies, namely born-too-soon AND too-small. SGA babies tend to have poor tone, very low activity levels, poor hand-to-mouth co-ordination, poor defensive reactions, and jerky movements of the limbs with restricted arcs. Such babies also tend to be floppy on pull-to-sit, and do not show good crawling, walking, sucking, or rooting, nor modulation when being move passively.

Since the SGA preterm babies are born behind by comparison with normally born, full-term babies, much has to be done to ameliorate their conditions at birth. SGA preterm babies are most 'at risk' of failure to thrive.* For example, if their family environment is poor they may be potential candidates for severe protein deprivation, so called kwashiorkor. If so, nutritional and other facilities such as appropriate baby's/family stimulation should be made available. By loan analogy with kwashiorkor, the conditions of deprivation of tactile stimulation of SGA preterm babies could be coined as "touchiorkor" (touching deprivation, from touch** + kwashiorkor).

This coining (of "touchiorkor") is not too preposterous, and fulfils two practical purposes. Firstly, no terminology can be found which succinctly expresses the condition of deprivation resulting from being born preterm or, even worse, SGA preterm. Secondly, as the research described in this thesis has progressed, and touching techniques have been developed for treating the premature babies, it has become increasingly clear that touching/stroking therapy, on the one hand, and (baby) massage, on the other, should be differentiated, since the latter is not only inappropriate, but suggests a scale of physical manipulation which could be damaging.

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* "Eating",to quote Newberger,Newberger & Harper (1976) "involves co-ordinating physiological and psychological needs with the aliments, schedules and relationships available outside ... "

** Touch. Verb

Middle English and Old French "tochier", "tuchier"; Modern French "toucher"; Spanish and Portuguese "tocar"; Italian "toccare". The Romanic "tocare" is probably an onomatopoeic formation from the syllable "toc".

also, ... Medical; to examine by touch or feeling, 1734.

and, ... to bring by touching into some condition, 1813.
.... Shorter Oxford English Dictionary, 1968 ed.

Thus the first syllable etymologically indicates touching, a gentle and benign operation; moreover, it may be used to name a precisely defined condition of deprivation, and is mindful of another profound (nutritional) deficiency suffered by many babies. As such, it is used sometimes throughout this thesis to indicate the condition of "touching deprivation" suffered by preterm and SGA preterm babies, the study of which led to development of the initial set of remedial techniques called MARISS. MARISS is described later in Chapter 4.0 of this thesis.

2.7 Interaction and the Special Care Baby Unit

The neonatal nursery is bound to inhibit or otherwise disturb the establishment of normal mother/infant interaction, and thus provides poor conditions for an intervention programme designed to compensate for the deficiency of tactile stimulation of preterm babies. With care, persuasion, and some planning this intervention can be extended to involve the parents.

LBW infants are isolated in their incubators, their "glass houses". In such demesne, amongst the tubes and wires of the monitoring devices, the baby is socially disconnected from everyone, including his/her parents. In these circumstances, neonatal psychology remains underestimated, particularly since it is not a question of life or death. The first week of life of LBW infants is likely to be rather difficult for both parents and infant, and thus transaction is quite rare. On the one hand, being born at-risk, the babies are mostly receiving unpleasant stimuli such as blood samples, X-rays occasionally, etc. On the other, the SCBU environments are to some degree intimidating to the parents who need to be encouraged to touch, to handle, to cuddle, and to stroke their babies; they have to be encouraged to feel their responsibility for caring in order to reduce, or even to avoid altogether, the "not belonging" feeling. This last phenomenon often appears amongst the mothers of LBW infants, some of whom articulate its causes as separation at birth and type of delivery. Pederson (1981) has summarized the overall situation in an interesting way which is well worth quoting, "...that there are three general hypotheses that have been offered to account for these findings:-

> "(1) there is something physically or neurologically wrong with the low-birthweight infant,
>
> "(2) there is something weird or artificial about the early environment of the low-birthweight infant, or
>
> "(3) low birthweight is a marker that in some ways disrupts parenting."

Is there a critical period for attachment? The trend of opinion is probably moving towards a negative answer to this question (Clarke and Clarke, 1979). There is, however, some agreement about the importance of the first week's events (Rutter, 1972; Douglas, 1975; Kennel, Trause and Klauss, 1975; Richards, 1978; Packer and Rosenblatt, 1979), and that other factors related to social class may amplify, minimise or overcome the effects of the physical environment (Sameroff and Chandler, 1975).

There is also increasing realisation that the two-way interaction between mother and infant is very important, as has been demonstrated by Klaus, 1972; Sameroff and Chandler, 1975; Kennel, Trause and Klaus, 1975; and others.

The transactional model (Sameroff and Chandler, 1975) emphasises the dynamic aspects of dyadic or triadic interrelations. Preterm babies are different from full-term babies physically and in their responses, and with respect to their environment; the evidence is that these complex and different circumstances have both direct and indirect effects on their development. The transactional model adopts the concept that neither the infant nor its environment are static, but change themselves and mutually change each other over time (Rutter & Madge, 1977; Stratton, 1977). As a model it is conceptually helpful to relate it to a transcendental equation in mathematics, or a transcendental relationship expressing feedback loops in control engineering with very few variables independent; such analogies are, at least, suggestive of the prevailing manner of handling premature babies, where the extreme practical difficulty of isolating independent variables is as noteworthy as the involved relationship between them.

The policies of minimal handling which apply to all Intensive and Special Care Baby Units have generally discouraged a "transactional dyad or tryad". Parents furthermore do not know what to do with their babies. Their infants capabilities are poor; in such circumstances, the parents are not in a state of preparedness for ready participation in social action since, unlike healthy full-term babies, their baby can neither show perceptual abilities in orientation and maintaining attention to social stimuli, nor a capacity for sustaining an alert and responsive state. On the one side, one has the healthy newborn ready to use and show his/her capabilities (Schaffer, 1977a) and on the other, the "sleepy", preterm, "not-ready" baby. This has led to several research workers investigating differences in sleep states between premature and full-term babies (Dreyfus-Brisac, 1974; Krauss, et al., 1977). The premature infants are typically found to have "less well organised" sleep rhythms, with shorter periods in each state; sleeping states are often difficult to differentiate from waking states since the infant's eyes are often open. The importance of this is evident in order to establish a dyad or a tryad, the state of the infant being crucial.

2.8 Importance of the State of the Infant

The ability of the newly born to modify wakefulness and alertness in order to "react" to a stimulus makes him/her an active partner in a dyad or a tryad transaction. This concept has been shown to be especially important in infant research; several research workers have drawn attention to the role of the infant's state in "changing", i.e. reacting mutually with, the environment (Gregg, Haffner and Korner, 1976; Escalona, 1962; Brazelton, 1973; Prechtl, 1968; Stern et al., 1969, in Packer and Rosenblatt, 1979). Thoman (1975) has pointed out that "state acts as a prelude, a mediator, and an elicitor, as well as a context for any interaction that occurs between the infant and his mother (Packer and Rosenblatt, Ibid, pp.9-10).

State will be responsible for development indirectly. The baby will attune to the caregiver who offers an attractive stimulus by prolonging his/her state of alertness, and conversely will withdraw from stimuli causing upset. Brazelton (1983) has consequently pointed out that state is the first control system of the newborn. This valuable concept embodies the principle that the processes used in control of the baby's states of consciousness can be seen as ego precursors, both seeking and incorporating stimuli. Thus by controlling input and output, and registering successes and failures he/she prepares the basis for the self-awareness which is so important for the establishment of the infant/caregiver transaction.

The more premature the baby, the less chance he/she has to become an active partner in the environmental relationship. It follows that stimulation suggests itself as an essential factor for encouraging the development of preterm babies.

2.9 Feeding of Preterm Infants

Fat is the main energy source for the newborn infant and it is essential to normal development because (amongst other reasons) it provides fatty acids necessary for brain development (Hamosh, 1983). Fat accounts for 40-50 per cent of the total calories in human milk or formula (Hambraeus, 1977, in Hamosh, 1983).

It is known that preterm infants have limitations in their capabilities for the absorption of fat. One of the reasons adduced for this is the immaturity of their physiological mechanisms concerned with digestion and absorption.

Recent study (Hamosh, 1983) declares that there is strong evidence that lingual lipase catalyzes the hydrolysis of dietary fat in the stomach. The function of lingual lipase on both digestion and fat absorption is of major importance in physiologic and pathologic conditions associated with pancreatic insufficiency, such as prematurity; this lipase appears before 26 weeks gestation, and it accumulates in the stomach before birth. Infants above 34 weeks gestation had significantly higher activity levels than infants of lower gestation. According to recent study (Wozniak, Fenton and Milla, pre-print, 1983), the sucking reflex start to develop from 33 weeks. It is the present author's view that the sucking reflex plays an important role in the secretion of lingual lipase. The sucking reflex development may as well start earlier, provided the infants receive 'appropriate' stimulation; such an effect would facilitate the preterm infants' "acceptance" of the bottle.

2.10 The Role of "Pleasant" Stimuli on the development of LBW Infants

> "..... and psychological and emotional needs are every bit as real as the need for bread, for shelter, for material security" (Baigent, Leigh & Lincoln, 1982).

The isolation of LBW infants in their incubators has already been mentioned above, with its concomitant loss of social awareness and relationships. Quite understandably, a common question posed by both staff and parents is, "Does the newborn have any psychology?". This question has particular import during the first and difficult week, when the babies born at-risk are receiving unpleasant stimuli from probing and insensitive apparatus.

The capacity of infants for experiencing pleasure or annoyance as a consequence of their sensations is quite real (Lipsitt, 1983, Crook and Lipsitt, 1976, and others). This is now fairly obvious but seems not always to have been taken into account.

The hedonistic processes by which the capacity of infants for experiencing pleasures (and annoyances) are expressed are mediated by physiological mechanisms; studies have been published revealing how pleasure and pain alter subsequent adaptive behaviours (Stome, in Lispitt, 1983). Moreover many human activities enhance pleasure and reduce annoyance, and this promotes learning through the "law of effect" (Lipsitt, 1983); it may be construed that this plays a part in promoting sensorimotor structures of the infant (Piaget, 1964 a), and hence makes learning possible.

However this matter is in its early days, and too little research has been carried out attendant on the seeking of pleasure and its reception. From a practical point of view, and certainly germane to the work described in this thesis, are also the consequences of the caretaker not being able to reduce the experiences of annoyance and increase the pleasurable ones, a deficiency which may have deleterious effects on parent/infant transaction and may well inhibit development. This issue is really crucial in coming to deal with tiny premature babies in incubators who are likely to experience mainly unpleasant stimuli; it is reasonable that they will be less able to compensate than are better equipped neonates, and certainly there is evidence that their problems of organisation in development are compounded (Greenberg, 1971) when subsequently they come to live in disorganised and depriving environments. The literature is very suggestive of the idea that lethargy and non-responsiveness of infants at risk reduces their capacity to elicit the necessary mothering from already overstressed parents. The further question is thus hardly rhetorical regarding what sort of pleasures are on offer, if any, for a tiny baby in an incubator full of monitoring devices, with too much light, and many unnatural and unpleasant noises? If this question can be posed, its resolution lies in the way in which the essential life-support apparatus can be arranged to accomodate to the psychological needs of the infants and/or tolerate a greater degree of skilled human intervention. Further possible controversy lies in the question of whether the baby discriminates between pleasurable and annoying stimuli; this matter, however, can readily be expressed in terms of the baby becoming contented, or not.

Leiderman (1978), reviewing the "critical-period" hypothesis, concludes that mothers bring, to the event of childbirth, memories of their own experience of maternal care; they also incorporate values and expectations derived from their own cultures. Maternal behaviour and attitudes are thus formed from what occurs in the prenatal period, by what is brought to the experience of childbirth, and also by events beyond childbirth. Leiderman points out that human beings are not so inflexible and unadaptive that the initiating and fixing of social bond must only be accomplished in a very brief period following birth; his assumption is that if mother/infant attachment systems are not activated at birth, they will surely become operative within the first months of life and, in ways not yet fully understood, should be maintained once they have been formed.

These recent views on non-plasticity and controversy over "critical-period" acceptance for the establishing of social bonds, provide new perspectives for both later recovery and later establishment of social bonds for children who, for a variety of reasons, have not been able to acquire them earlier. However, in parallel, there are other recent views concerned with environmental influences on infants' development which need to be taken into account. Packer and Rosenblatt (1979) state that

> "... the events of the first week of a child's life can be viewed as having a significance in themselves. Through processes of mutual modification, mother and infant begin to establish a pattern that will provide the basis for the long development to adulthood. The infant's responses to his mother give specific information about his individual needs."

It follows that it is crucial for a mother to understand her baby, and to have an appropriate set of attitudes towards him/her after the first week; desirably, the caretaker should acquire knowledge of what annoys and what gives pleasure to the baby. Obviously, in terms of practical action, the mother's position in the social economy is important. How much attention, and even how much food a mother can give to her baby and, when there is crying, how much of it she can tolerate, must be strongly influenced by her place in the system of production and consumption (Ingleby, 1976, in Richards, 1976). This standpoint accords with the view that factors related to social class may amplify, minimise or overcome effects of the physical environment (Sameroff and Chandler, 1975).

This assembly of viewpoints indicates the importance of the stimuli offered to premature babies. If mothers do bring to the event of childbirth memories of their own experience of maternal care, and if this is influenced by their position within the socio-economic system of production and consumption, it is of interest to note that Waddington's (1962) controversial view of "genetic endowment relativity" argues that such environment influences of the past could conceivably become genetic in the future. What is not in the realm of contention is that mothers who have not themselves been caressed could, and can be trained to become "caressing caretakers".

2.11 Importance of the First Week of Life

Weight is usually lost during the first week by LBW infants, and may not start to be gained until as late as 2-3 weeks. Early weight gain occurs only rarely. The daily charting of weight gain has significance both for the staff and for the parents, in that:-

(i) it shows how the infant is thriving,

and (ii) it psychologically helps parents to believe that the tiny one will survive and belong to them, and hence overcome "anticipatory grief" (Caplan, Mason and Kaplan, 1965).

As already commented in section 2.9, it is known that fat provides about half the energy in the diet of a milk-fed infant. It is also known that preterm infants have limitations in their capability for absorption of fat; this is due not only to the type of fat ingested, but because of the immaturity of their physiological mechanisms concerned with digestion and absorption.

So far as psychological development is concerned, there is a trend towards thinking that the events of the first week of a child's life can be viewed as being significant in themselves. In reality, through processes of mutual modification, mother and infant start to develop a pattern which will provide the basis for the long development to adulthood. The infant's responses are feedback to the mother giving specific information about individual needs. However, the organisation and ambiance of the hospital will impose demands on the pair; there will be no standard to the response, and the very process of adjusting to these demands will create new and varied situations for both mother and infant from which they will experientially develop mutually satisfying modes of relations. As Stratton (1977) has pointed out, the most crucial function of the new-born period may be to "establish in the mother an understanding of her baby and an appropriate set of attitudes towards him" (in Packer and Rosenblatt, 1979). It might as well be said that the situation is even more crucial for the at-risk, premature infant who exists as an "in-between" human being, neither foetus nor accomplished newborn, and who tends to be treated according to the idiosyncracies of those in charge of Special Care Baby Units and, of course, his/her parents.

2.12 Especial importance of Sucking for Preterm babies

It is undeniable that sucking* occupies a very important role in the growth and development of the premature baby. No baby can be compelled to suck a "dummy", an action which could help the reproduction of saliva which, in its turn would encourage the act of sucking; this particular loop cannot be closed in terms of "sucking" alone if the baby does not perform the action in the first place. Subjects act, operate, and then may be said to behave (Piaget, 1971); psychologists are in a position to detect phenomena, but do not necessarily know their nature, at any one time. Experimentation is required but is fraught with difficulties; one of the assumptions underlying delay in bottle or breast feeding premature babies is their inability to swallow and suck in a coordinated way, since this can be dangerous and cause death by choking and suffocation. In particular, a baby with 27 weeks gestational age is considered not to have coordinated sucking, breathing and swallowing, this being the justification for not providing a bottle. This has now been questioned, and research has started on why some preterm babies can cope with a bottle; elements of importance in this are the probable need for a special teat to be designed (or imported from elsewhere), an increase in parent participation, and an increase in the nurse/baby ratio.

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* Suck/Sucking.

Verb. trans. To draw (liquid, esp. milk from the breast) into the mouth by contracting the muscles of the lips, cheeks and tongue so as to produce a partial vacuum.

also, to imbibe (qualities, etc) with the mother's milk, 1586, and to extract or draw (moisture, goodness, etc) from, of, or out of a thing; to absorb into itself, late ME.

"The milke thou suck'st from her did turne to Marble",
.......Shakespeare.

and from OE, Suck + ing, that sucks milk from the breast, that is still being suckled, unweaned.

also Fig., not come to maturity; not fully developed, 1648.
..............Shorter Oxford English Dictionary, 1968 ed.

As the footnote (*Suck/sucking) indicates, sucking is an immature way of being nourished physically and psychologically. The art and mechanism of sucking is present in all species of mammals; its importance, especially for premature babies, is quite obvious. It is a sign of maturing within immaturity; after birth, as an absolute token of newborn competence, premature babies should be encouraged to develop it as early as possible. However, the capacity for adaptation to the new environment by the "in-between" baby is enormous, and probably has been underestimated by those who defend the "foetus" model of premature babies, and perhaps overestimated by those supporting the "newborn" model. Those who defend the "foetus" model will tend to adopt less new environmental stimuli, for example, and more provision of similar noises to those of the womb as additional auditory stimulation. This particular school of practice will also tend to leave the baby to be tube fed for a longer time, on the assumptions that maturation is required, and that coordination of swallowing, breathing and sucking with less than 31 week GA does not exist.

A looped paradox is thus apparent in that babies need to suck to be fed, and derive psychological advantages from so doing, but premature babies cannot suck! This situation is further compounded by other actions which are taken to enhance survival, which not only do not encourage sucking but inhibit it.

The importance of sucking can well be appreciated by considering the number of authorities, e.g., Bowlby, 1958, who have identified sucking, clinging and following as the composite responses, together with crying and smiling as the input signals in baby/mother interactions.

2.13 Influence of Posture

Grenier (1983) has shown that changes in behaviour normally ensue, if the head of a baby is held temporarily in position by the hands. This has led Grenier to insist that it is essential to take into account the posture of an infant, and to ensure a consistent level of proprioceptive stimulation during any type of clinical observation. The changes in behaviour under such simple conditions of test as described by Grenier, are as follows:-

(i) intense interaction with the examiner,

(ii) maintenance of the sitting position, and relaxation of the upper limbs,

(iii) spontaneous activity,

(iv) reaching out for a toy, if offered,

and, (v) sometimes grasping the toy purposefully and accurately.

These experiments suggest that unresponsive babies, during their first week of life, may become responsive if the caretaker liberates the baby's motor actions by a technique of holding the neck and supporting the head.

2.14 Mimicry, and the Role of Infant's gestures

Although not central to the subject matter of this thesis, communication of the infant by gesture is of intense interest as one class of the feedback signal. As a source of information, this issue deserves mention here in view of observations made during the course of the research, and recorded later.

Naouri Aldo (1983) has stated the hypothesis that a non-verbal discourse develops around and about the child's body, and sheds further light on the subject. This discourse is naturally bilateral; the child makes his/her movements and the parents gestures carry a specific message, unconsciously made towards the newborn. The latter can be considered as the "acting out" of the parents feelings unconsciously.

Recent French studies (1983) have shown the importance both of gestures on premature babies, and the ensuing communication with them. Expressive movements provide sensory data to the brain and for the cortical-integrative activity that produces emotional experience. Socially, facial expressions provide a set of feedback signals that are important in fostering relationships. It is now well established that expressions of emotion constitute communicative and motivational cues for the perceiver (Izard, 1971, 1977 , and 1978).

In the words of Kagan (1978), "the child's growth will not be fully understood until we gain further insight into those aspects of development we call emotional."

2.15 Tactile Stimulation

"There are many events in the womb of time, which will be deliver'd",... Shakespeare, OTHELO, 1, (iii).

There has been increasing concern regarding the role of early stimulation in the development of preterm babies. At risk of repetition here, but justifiably so, babies in incubators with minimal handling, constant light, continuous mechanical sounds, and monitors which tend to mask agreeable human sounds, are isolated in a relatively unchanging environment. Early studies on stimulation supported the idea that extra stimulation increased weight gain in low-birthweight babies, and improved the scores in conditions tests (Freeman E., 1969; Siqueland, 1969, Solkoff, et al., 1969; Wright, 1971). That stimulation increases growth rates and developmental progress, according to specific definitions, has been pointed out also by Kraemer and Pierpoint (1976). Tactile stimulation was reported as having significant effect on weight gain (Solkoff, et al., 1969; White and Labarda, 1976; Powell, 1974, Rice, 1977, 1978), and decreasing the incidence of physical complications, especially respiratory difficulties (Freeman, 1969). However such studies involve other factors besides tactile siimulation, and it is thus difficult, if not impossible, to isolate and identify the unique effects of the latter from the data hitherto available.

Tactile sense holds an important place in the life of every human being, and is significant in many cultures; at the commencement of this research work it was thus strange to note the relative lack of studies designed to assess the unique effects of tactile stimulation on infants born "at-risk". It was reasonable to suppose in a hospital environment that this was partially due to the physical problems of manipulating babies in incubators in a way which would yield systematic results, and to the lack of a developed system of tactile stimulation. On the positive side, the early stimulation studies did suggest that extra handling could accelerate growth and psychological development, and that the beneficial effects persisted after discharge from hospital. It followed that unresponsive babies were probably those most in need of extra stimulation, although whatever was done would be for preterm babies as a set. It was also realised that such a study could well contribute to the development of nursing techniques within SCBUs.

The barriers to conducting such a programme are a subtle blend of policy and culture. The policies of minimal handling which are extant in all Intensive and Special CBUs predated such tactile stimulation programmes, and thus discouraged them. Not to be disregarded as a factor in sophisticated Western societies but not in, say, a society such as Brazil, is that people look on "touching" behaviour as forbidden by cultural, class (Montagu, 1978), or even religious principles; these modern taboos are powerful but not irresistible. As J. Lioner Taylor says in "The States of Human Life", 1921, p.157, in Montagu (1978, p.1),

> "The greatest sense in our body is our touch sense. It is probably the chief sense in the processes of sleeping and waking; it gives us our knowledge of depth or thickness and form; we feel, we love and hate, are touchy and are touched, through the touch corpuscles of our skin."

Touching achieves an important role in developing the ability of the baby to become an active partner in changing his/her environment. As quoted before, "State is the first control system of the newborn" (Brazelton, 1983), and touching is the earliest sensory system to become functional in many human and other animal species. Perhaps next to the brain, the skin is the most important of all organ systems.

These complex and interrelated matters justify, rather than deter a further programme of studies with preterm babies using tactile stimulation. Such a study may be seen as an extension of nature; the sense of touch, the sense most closely associated with the skin, is the earliest to develop in the human embryo. The foetus moves in the womb and touches the mother, "kicking" her. Immediately a "communication" starts by touching. Instinctively, the mother brings her hand to her stomach to touch the "kicked" part, and to "feel" her baby; she may take the hand of her partner, and bring him to touch the "kicked" part as well. She may say something to the baby; she will wait for the next "kicking". In such ways, touch has an important role in the establishment of mother/father/caregiver - infant transaction, even before birth,

The embryo at the earliest stages has neither eyes nor ears, yet its skin is highly developed, although not at all comparable to the sensitivity it will later acquire. In the benign uterus, the baby is bathed by his mother's amniotic fluid and enveloped by the soft walls of the womb. The phrase may figuratively be borrowed that the conceptus (the organism from conception to delivery) has been "rocked in the cradle of the deep", and leads a fluidic existence.

3.0 DESIGN AND METHODOLOGY

3.1 Intervention Programmes

The research literature on both brain-damaged and socially-disadvantaged children suggests that early educational programmes have beneficial effects on later functioning. Early intervention in these cases has been shown to promote readiness to organise experience, and to learn in ways more nearly congruent with chronological age (Williams and Scarr-Salapatek, 1971; Scarr-Salapatek and Williams, 1973).

Recent study (Barnard and Bee, 1983) has shown long-term (2 years) effects of early stimulation programmes on mental and motor development (MDI and PDI) as measured by Bayley Development Scales. However, the number and capability of intervention programmes are still small; moreover, knowledge regarding the techniques for such interventions is inadequate and sometimes primitive. Such literature as exists on this matter requires close scrutiny in order to assess the merits and demerits of the various techniques which have been invoked for the purposes of studying babies at-risk.

Early intervention may prevent a compounding of the problem, which tends to occur too readily when the environment does not adjust appropriately to the infant "at-risk", or even to the infant not at risk. There is no certainty in this situation and, as already mentioned, the effects of the environment may attenuate, amplify or over-ride the consequences of perinatal trauma (Sameroff and Chandler, 1975). Notwithstanding such difficulties, by increasing the potential for early interventions it should become possible to develop more sophisticated preventive and therapeutic approaches which, in their turn, should enable evaluation of at-risk infants to take place as early as possible (Brazelton, 1979). It is important to note that the time of commencing intervention is generally considered to be a critical variable; also, the literature of the 1970s suggests that the length and continuity of the intervention are quite crucial.

In a recent paper, Bronfenbrenner (in Clarke and Clarke, 1976) discussed three different kinds of interventions:-

(i) based on a home-centred tutoring programme,

(ii) based on parent-child intervention,

and (iii) the ecological intervention.

From the standpoint of a developing country, Bronfenbrenner suggests that programmes for the children from the most deprived groups which focus attention solely on the child are ineffectual, as also are those which centre on the parent-child relationship. He also emphasises that without changing the desperate circumstances in which the family is compelled to live, no strategy of intervention is likely to be effective. This however, is primarily social criticism and is not an argument against the establishment of viable techniques. Furthermore, the vast majority of evidence is that the family is the most effective and economical system for fostering and sustaining the development of the child, and hence should be involved actively in the success of any intervention programme. Tjossem (1976) has pointed out that parents are efficient instructors of their children, provided they receive adequate support; success in promoting the development of their children rests fundamentally on the motivation, participation and acceptance of responsibility of parents. Such an approach must be tempered by family circumstances, since success with operations of this sort is fraught with difficulty because of family worries about the task of survival; these family groups, either bringing up full-term or very low-birthweight babies are in need of expert help in motivating and orienting them.

The research described in this thesis compares two types of Post-Natal Care Programmes (PONCAP), both based on intervention, for their efficacy in promoting the neuro-behavioural and social-psychological development of both very low-birthweight and full-term babies. It has been recognised that for groups obstetrically at-risk, the relative cost-effectiveness of preventive techniques is important, and it is anticipated that this must be taken into account in making any recommendations.

3.2 Hypotheses

The following are the hypotheses on which the project has been based:-

H(1) Early and systematic direct-sensorimotor stimulation may enhance neuro-behavioural and psychological development of very low-birthweight and full-term babies.

H(2) Very low-birthweight babies, who are provided with early direct sensorimotor stimulation, may achieve the same level of neuro-behavioural and psychological development as full-term babies;

H(3) Very low-birthweight and full-term babies involved in early and systematic sensorimotor stimulation may change the attitude of their mothers towards them, thereby making them more responsive to their babies cues, and hence establishing better social bonds than those enjoyed by the control groups.

H(4) Early and systematic indirect stimulation via parent counselling and instruction may enhance neuro-behavioural and psychological development of very low-birthweight and full-term babies.

H(5) Very low-birthweight babies who are provided with early and systematic indirect stimulation via parent counselling and instruction, may achieve the same level of neuro-behavioural and psychological development as full-term babies.

H(6) The participation of the parents of very low-birthweight and full-term babies in early and systematic indirect stimulation (counselling and instruction) may change the attitudes of babies towards their mothers, who are then likely to be given more cues, thereby establishing better social bonds than those existing within the control groups.

3.3 Macedo Adaptation of Rice Infant Sensorimotor Stimulation (MARISS)

Low-birthweight infants are very important since they represent a substantial number of births, around 7 per-cent (Dear, 1982), and are at an increased risk of later development problems. The evidence points to the different outcomes being mediated by environmental conditions, and thus such groups provide an opportunity to analyse the effects of intervention programmes on subsequent development.

The initial and necessary practical steps were thus clear, namely to investigate whether, or not, early systematic tactile stimulation would be effective for full-term babies, and if such would be benign and effective to babies at-risk. However it was first necessary to fashion a tool, since the research could not proceed without the development of a technique of stimulation appropriate to the experimental groups. Initially ergo, Rice Infant Sensorimotor Stimulation (R.I.S.S.) was used, but the acquisition of skill concomitant with systematic observation of the responses of the babies enabled MARISS, a technique dependent only on tender tactile stimulation, to be developed. MARISS, in consequence, is not only a useful outcome of the research programme, but was pivotal for carrying out the investigation.

MARISS, unlike R.I.S.S., does not use visual, auditory or kinesthetic stimulation, and needs only tactile skill; interpretation of the results is thus facilitated, since interactions between the various stimuli are eliminated. In the employment of it there are two coincidental objectives:-

(i) to encourage growth and development of the preterm infant,

(ii) to compensate deficiencies arising from the circumstances of preterm birth; the most obvious circumstance is early detachment and thus MARISS, in this context, has been styled a "touch to attach" technique.

R.I.S.S., and subsequently MARISS were offered for both groups of experimental full-term babies, and not offered for the control groups. Behaviour before, during and after each session was recorded, and physical assessments were taken weekly. Neurological, neurobehavioural, mental, and motor scales were applied.

The technique of MARISS is described in Chapter 4.0.

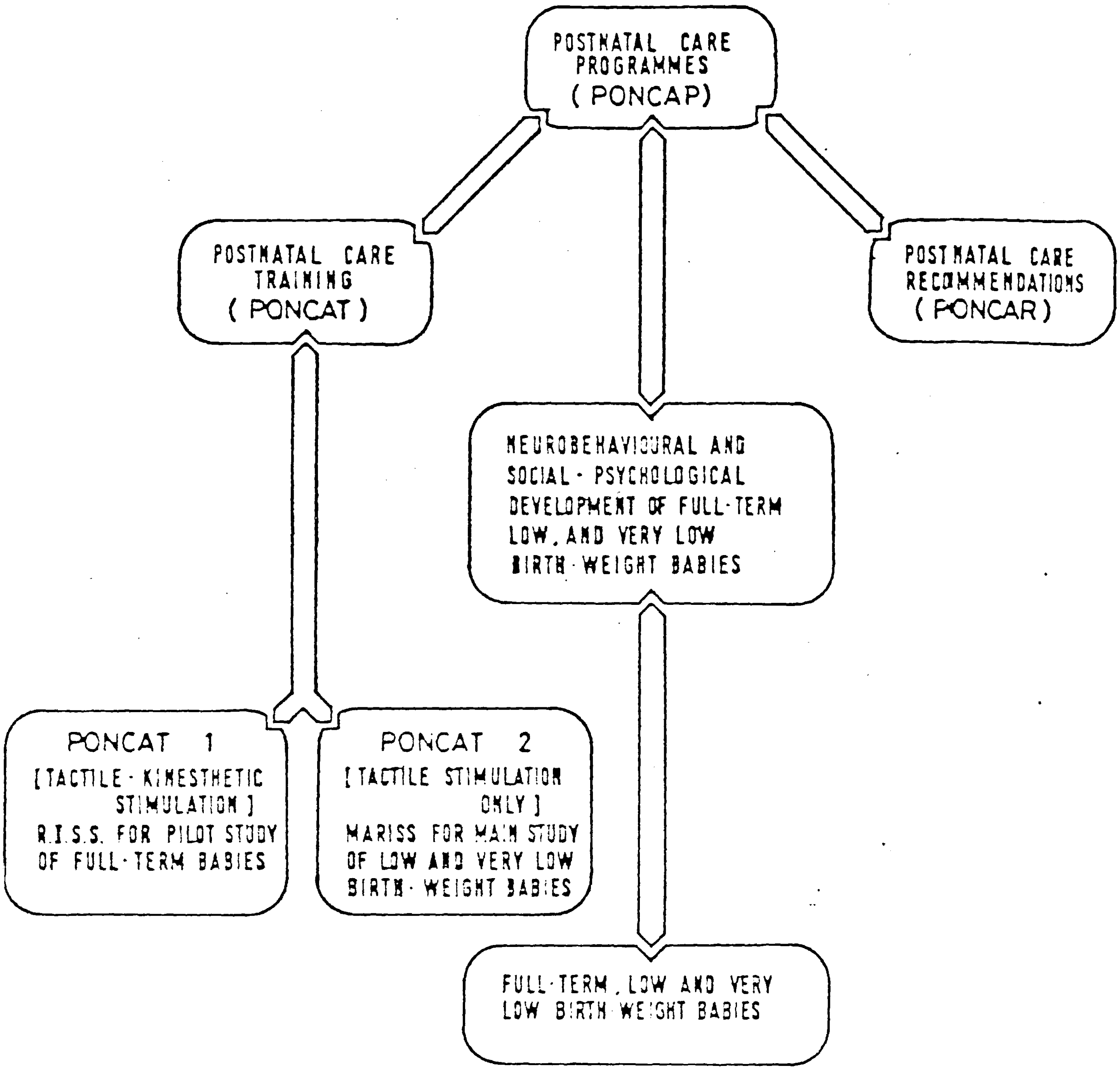

FIGURE : 3.1 POSTNATAL INTERVENTION PROGRAMMES FOR PROMOTING THE NEUROBEHAVIOURAL AND SOCIAL - PSYCHOLOGICAL DEVELOPMENT OF FULL - TERM , LOW AND VERY LOW BIRTH-WEIGHT BABIES

3.4 Method and Design

The research programme was carried out in one clinic and three hospitals in the London (UK) region. The components of the study are illustrated schematically in Fig.3.1. The whole programme was given the acronym PONCAP; the derivatives of PONCAP are PONCAT and PONCAR. PONCAT was a study carried out in two different stages:-

(i) A pilot study (PONCAT-1) in a clinic with full-term babies; this enables existing tactile-kinesthetic stimulation to be appraised, and enabled a tactile (only) stimulation system to be developed.

(ii) The main longitudinal (2 and a half years) study, with premature babies, at Hospitals 1, 2, and 3 (PONCAT-2); this used MARISS, and thus enabled a system entirely independent of both apparatus and other systems of stimulation to be investigated and defended.

The pilot study was carried out to the following design:-

3.4.1 Design of the pilot study

Considerable difficulties attended the commencement of this study, not least because the initial propositions were considered to be ideosyncratic, and hence an enthusiastic forum of support was not forthcoming.

Table 3.1, following, categorises the number of subjects who became available at each stage. In the event, only 3, 4, 2 and 3 FT subjects, respectively, in each group (N = 12) were recruited, these being shown in parentheses in Table 3.1. The design furthermore included 10 VLBW babies in each group; it was not possible to gain access to either VLBW or LBW babies in the pilot study.

TABLE 3.1 Number of Subjects available for Pilot Study

SUBJECTS	CONDITIONS				Total
	Post-Natal Care Recommendations	Post-Natal Care and Training	Placebo	Non-Inter-vention	
Full-term babies (FT)	10(3)	10(4)	10(2)	10(3)	40(12)
Very low-birthweight babies (VLBW)	10(0)	10(0)	10(0)	10(0)	40(0)
Totals	20(3)	20(4)	20(2)	20(3)	80(12)

3.4.2 Placebo control

A frequent finding in the social sciences, and elsewhere, is that any attempt to investigate human behaviour reactively changes that behaviour (Baber, 1976). This phenomenon occurs here and it is important that such experimental effects should be separated from the effects of the two intervention programmes which are proposed. For this reason, "placebo" control groups of full-term babies received equivalent experimentation time (visiting once weekly for eight weeks) and assessments (body length and head circumference), but no intervention programmes.

3.4.3 Design of the main study (Very-low birthweight babies)

TABLE 3.2 Number of LBW and VLBW babies as subjects per hospital

SUBJECTS/ HOSPITALS	CONDITIONS: Post-Natal Care Training (PONCAT-2)			CONDITIONS: Non-Intervention			Total
	Boys	Girls	Sub-Total	Boys	Girls	Sub-Total	
Hospital 1	4	2	6	4	2	6	12
Hospital 2	2	4	6	2	5	7	13
Hospital 3	7	12	19	13	9	22	41
Totals	13	18	31	19	16	35	66

Table 3.2 gives the number of subjects. There were special features of the subjects, and there were special features at each of the 3 Hospitals, as follows:

Hospital 1.
12 subjects*(8 AGA and 4 SGA), 8 boys and 4 girls, were assigned first to the non-intervention group (N=6 4 boys, 2 girls, of which 2 SGA), to avoid contamination, and then to the intervention group (N=6 4 boys, 2 girls of which 2 SGA). All subjects received the routine care. None of the mothers was herself willing to stroke her baby although, after watching the session, all agreed that the babies seemed to like it; however they each feared to do something damaging or wrong to their babies, or had a feeling of detachment which inclined them not to stroke. Only one mother continued the programme following the author's initiative. Unsolicited, 70% of the mothers (both groups) expressed opinions to the author that tiny babies do not like to be "bothered", touched, undressed, etc., but would prefer to stay quiet, sleeping and isolated.

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* The subjects were recruited from June to December 1980

Hospital 2.

13 subjects (11 AGA and 2 SGA), 8 boys and 5 girls, were randomly assigned to the control group first (N=7, of which 1 SGA) and to the experimental group (N=6, of which 1 SGA)*. The infants were recruited from January to August 1981.

All subjects received the same routine care. Two parents, who were very willing to participate, were discarded in order to avoid bias. 25% of the mothers continued the technique following the instructions of the author.

Hospital 3.

41 subjects (23 AGA and 13 SGA), 19 boys and 22 girls, were recruited from January 1981 to December 1982.

The first sample (N=8) was divided into the two groups by matching for birthweight and gestational age, and SGA or AGA conditions (1 SGA in each group); the second sample were allocated to two groups on a quasi-random basis and was recruited in three phases**. Non-intervention group with 18 infants, of who 3 SGA and intervention group with 15 infants, of whom 8 SGA.

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* An attempt to have both groups at the same time had failed. Mothers (control group) who observed the responses of the infants (experimental group) declined to be in the control group. The technique was taught to all mothers and fathers at that time and the infants were discarded. After discharge of that group we randomly assigend infants to control and experimental groups. The experimental infants were discarded. After this group discharge new assignment for the two groups and control infants were discarded.

** The infants' recruitment was interrupted thrice due to necessity of the experimenter to go abroad.

All the subjects received the same routine care. None of the mothers was willing to stroke her baby herself, but they did agree to the treatment; after watching some sessions, many of the mothers became convinced that the babies did enjoy the treatment.

By arrangement, none of the mothers stroked her baby during the first week in order to avoid experimental bias due to different fingertip and palm surface pressures being exerted with different caressing techniques of the various mothers.

At Hospital 1, parental permission was not sought before the programme started. It would be stopped if parents did not agree with it*. Whenever parents or grandmothers asked about the programme information was then given verbally. The work was approved by the two consultant paediatricians and explained to the nurse staff in a meeting before the programme started.

At Hospitals 2 and 3, parental permission was sought verbally. A letter (see Appendix IX) was then given to the parents. No written consent was sought. The work was approved by an ethical committee.

Discharge policies and Special Care routines were the same for Hospitals 1, 2 and 3.

Hospital 1 has facilities for mothers to "room in"; their rooms were attached to the SCBU. Nevertheless, it was observed that 50% of the mothers did not stay in hospital longer than their stipulated residence period, either because of other children, "fear" to stay closer to the baby in the event of he/she not surviving (the "anticipatory grief" of Caplan, Mason and Kaplan, 1965), or they did not want to stay away from their husbands.

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* One mother had asked not to continue with the stimulation because her baby did not respond the same way when she tried to stroke her.

Weighing frequency differed amongst the three hospitals. Hospital-1 weighed the infant once a week, Hospital-2 weighed two or three times a week, whilst Hospital-3 weighed every day.

3.5 Subjects

3.5.1 Pilot study in the clinic with full-term "normal" babies

12 subjects were randomly assigned to one of the groups described above, using a Table of Probablistic Numbers. The subjects were already discharged and in "normal" conditions, according to the Health Visitors. The Health Visitors did not know to which group each baby was assigned; all of the babies were Caucasian.

3.5.2 Main study with preterm (low and very LBW) babies at three Hospitals

The hospitals were chosen only on the grounds that they were likely to yield the necessary number of subjects and to grant the necessary facilities. 66 infants (25 boys and 31 girls), spread amongst three hospitals in England (one in the Home Countries and 2 in London), and assigned to experimental (Intervention with direct stimulation only - PONCAT-2) or control groups (non-intervention) according to the following criteria:-

(i) birthweight $<$ 2.5 kg;
(ii) gestational age $<$ 37 weeks;
(iii) no ventilation treatment beyond day-3.

Any baby assigned to a group starting ventilator treatment at day-3 or afterwards was discarded. Any baby assigned to a group starting physiotherapy at any day within the first 3 weeks was discarded. 61.3% of the mothers (intervention) and 68.6% (non-intervention) were Caucasian.

Birthweight (BW), Gestational Age (GA), Problems at birth, Perinatal and Neonatal Complications and Socio-Economic Status (SES) were taken into account as matching variables. All infants had Intensive or Special Care, tube-feeding, temperature control, attention to episodes of apnoea, and detection of hypoglycaemia; Gestational Age (GA) was assessed by Dubowitz's Method (Dubowitz and Dubowitz, 1977), whenever there was doubt, by a resident doctor.

3.6 Infants' Assessment at Birth

Information about birthweight, GA, length, head circumference, Apgar Scores, complications at birth, postnatal and perinatal complications were all taken from the case notes.

3.6.1 Pilot Study:

Birthweight only was recorded from the clinic notes. The mean birthweight for the PONCAT-1 (see section 3.8) group was 3.4kg, and ranged from 2.5kg to 4.1kg. The mean birthweight for the PONCAR group was 3.7 and ranged from 3.5kg to 4.0kg. The mean birthweight of the Placebo group was 3.7kg and ranged from 3.0kg to 4.3kg; that of the control group was 3.0kg, and ranged from 2.7kg to 3.3kg (see Table 5.1 for the raw data).

3.6.2 Hospital Studies:

Birthweight, Length and Head Circumference were taken from the case notes. The mean birthweight of the 31 experimental infants was 1.52kg, and ranged from 760g to 2.0kg; that of the 35 control infants was 1.58kg. and ranged from 840gm to 2.160kg.

3.6.3 Estimate of gestational age (EGA).

A scoring system, derived from a combination of external and neurological criteria based on a clinical examination (Dubowitz and Dubowitz, 1977), was used whenever there was doubt; this was applied by medical doctors who did not know the group of infants.

3.6.4 Reflexes

Primitive reflexes have always been used whenever assessing the neurological behaviour of the newborn. Despite the controversy surrounding the detection of neurological abnormalities in the newborn (Dubowitz and Dubowitz, 1977), their asymmetry or absence, or even their low threshold is a sign of pathological conditions. It could well be said that the characteristic appearance of primitive reflexes is indicative of normal newborn behaviour. It is expected that a "normal" full-term baby will be born with:-

(i) strong regular sucking,
(ii) partial head turning towards the stimulated side for rooting,
(iii) hand grasp,
(iv) crawling,
and (v) passive movements (arms and legs).

This however is not so with premature births. The reflexes above were assessed (before the stroking session), for the purposes of this study, using the following Prechtel (incorporated in Brazelton's scores) scoring system:-

X = omitted,
0 = reflex cannot be elicited, despite several attempts,
1 = hypoactive response (10% of babies only),
2 = normal responses (80% of babies),
3 = hyperactive response (10% of babies only),
A = asymmetrical response, either in terms of lateralization or segments of the body (arms versus legs).

The scores given for the four primitive reflexes of (i) to (iv), inclusive, above, together with the passive movements were subjectively evaluated, on the assumption that they would give a reasonable "base-line" with which to start.

3.6.5 Apgar Score

This well-known scoring system was used; it is based on a combination of:-

(i) appearance (colour),

(ii) pulse (heart rate),

(iii) grimace (reflex irritability in response to stimulation of the sole of the foot),

(iv) activity (muscle tone),

(v) respiration (respiratory effort); this was used with all babies at birth, and was recorded from case notes.

The mean Apgar score, at 1-minute, of the 31 subjects of the experimental group was 6 and ranged from 1 to 10. The mean Apgar score of the 35 control infants was 6, and ranged from 1 to 10. The mean Apgar score at 5-minutes of the 31 members of the experimental group was 9, and ranged from 6 to 10; the same for the 35 control infants was 8, and ranged from 4 to 10.

3.7 Training of Personnel and Home Visits

The author received training at Dallas from Dr. R. Rice in the technique of stroking. A model doll was used initially, followed by practice in the Special Care Baby Unit of a Dallas Hospital; this training programme had the goal of conveying clear and standardised instructions to the experimenter in order to attain a consistent technique of stroking.

In the studies carried out subsequently (in the UK) and described here, the following principles were followed:-

3.7.1 Pilot Study

PONCAT-1 group.

Mothers were visited at home within 7 days after delivery and taught the technique of stroking; they were thereafter visited weekly for 8 weeks. Mothers would speak about their baby's response to the stroking. The investigator would ask the mothers to repeat once the technique in order to correct any mistakes.

PONCAR group.

Mothers were visited at home, within 7 days after delivery, and printed counselling and instructions (Open University "The First Years of Life", 1979) were selected by the investigator according to the observed interest or anxiety of the mothers, and a copy given to them. They were thereafter visited weekly for 8 weeks.

Placebo group.

Mothers were visited at home within 7 days after delivery, for only a "chat". They were thereafter visited weekly for 8 weeks.

Non-intervention group.

Mothers were visited at home within 7 days after delivery. They were not thereafter visited. They were called back to the Clinic for the Mental (MDI) and Motor (PDI) Development Assessment (Bayley).

At the first visit and thereafter at the weekly visits PONCAT-1, PONCAR and PLACEBO babies, physical measurements (head circumference and length) and weight were reported by the mothers. These items of data were not used because of their inaccuracy.

3.7.2 Main Study

Mothers and fathers were encouraged, and taught to continue stroking their babies after 3-weeks experimental time, during which only the experimenter stroked the babies whilst contriving only the minimum of variation of the finger tip and extended palm pressures of "touching". A standard performance was required from the mothers and fathers.

Normally 48 hours after birth, and always within 5 days, the experimental group mothers were contacted and told about the study. They were encouraged to continue with the stroking technique after the three weeks experimental period. There was no necessity for mothers to give written consent, and none of the mothers denied participation. Fathers were also given continual encouragement to stroke their babies. Each mother was told that her baby would be examined in hospital between 2 and 4 months corrected age (Hospital 1); in the cases from Hospitals 2 and 3, there were to be two home visits, once at 40 weeks life age, and then between 2 and 4 months.(mean of 3 months adjusted age).

3.8 Post-Natal Care Intervention Programmes (PONCAP)

Figure 3.1 schematically shows a relationship between the Post-Natal intervention programmes which have been invoked for the work described in this thesis. The classification shown in Figure 3.1 could be extended, but has here been restricted to the work carried out by the author.

3.8.1 Pilot Study

The pilot study had only full-term babies. Furthermore PONCAT-1 involved no variation on the technique of Rice, referred to elsewhere in this thesis as R.I.S.S.

Post-Natal Care Recommendations (PONCAR) included a set of eight leaflets (not reproduced here) selected and extracted from

"The First Year of Life", a course concerning Baby Care and published by the Open University, 1979.

Post-Natal Care Training (PONCAT-1) utilizing R.I.S.S.,was invoked in order to teach each mother a technique for communication with her infant. The following verbal instructions were given to the mother whilst the experimenter was demonstrating the treatment:-

"Place a blanket or nappy over your lap. Place the baby, face up, on your lap, undress him, unpin his nappy, and leave it covering him loosely in case you need it. Make sure your nails do not have any rough edges on them. The baby has a very delicate skin. Repeat each stroke three times. If your baby goes to sleep, continue stroking. In fact, he may become so relaxed that he will fall asleep while you are stroking, but the stimulation will work whether he is asleep or awake, so do not stop if he goes to sleep. If the baby starts crying while your are stroking him, he may be hungry. Feed him and as soon as he is satisfied, start stroking again. Remember, repeat each stroke three times and look at the baby's eyes while you are stroking him.

Start with his head. Gently, stroke his head with your finger tips. Cover his head with the fingers of both hands and stroke towards his face. Turn him a little to one side and gently stroke the back of his head with a downward stroke. Now stroke his face, starting with his forehead; stroke with two fingers; stroke from the centre toward the temple. Now stroke his cheeks, nose, and chin. Stroke from the nose out to the ears and then from the chin downwards over his throat.

Now take his right arm and stroke from the shoulder to his finger tips. Now start stroking his chest. Start with his neck and with both hands gently stroke downwards with the

finger tips of both hands. Stroke downwards over his chest and tummy, and over his genitalia. Now extend his right leg and hold his foot while you stroke with your other hand the entire leg. Begin with the thigh; let your fingers encircle his leg. As you come to his foot, put your thumb on the sole of his foot, whilst your fingers are on the top, and exert slight pressure on the sole of his foot with your thumb. Repeat with the left leg.
Turn the baby on his stomach and stroke the back of his head again, starting at the top and stroke down to his neck. Now with the fingers of both hands, start stroking from the neck down his back over his buttocks. Now start with his right thigh, stroke the entire leg and foot. Repeat with the left leg. The stroking should last ten minutes. If you finish before ten minutes has elapsed, turn the baby over and repeat the treatment.
You may dress the baby now; look at his face while you are doing this.
Now the last part of the treatment is very important also. Pick him up and hold him close to your breast and rock him gently back and forth. You can walk around while you are doing this or you can sit in a rocking chair. Look at the baby's face while you are holding him.
You should hold or carry him for another five minutes. This time is very important; do not cut it short."
- Copyright from the Thesis of Dr. R.D. Rice (1975).

The instructions were given twice, to the experimental group (PONCAT-1) mothers only.

3.8.2 Main Study

The main study involved the development and refinement of MARISS, and its application, as expressed in PONCAT-2 (see Fig. 3.1). MARISS is described in Chapter 4.

The assessments of the efficacy and consequences of MARISS have been devided into two categories:-

(i) assessment of the intervention and control groups during the first days of life,

and (ii) subsequent to (i), over the following period of 30 months.

These assessments come under the general heading of PONCAP (see Fig. 3.1), whilst the extant recommendations come under PONCAR. The Results appear in Chapter 5, the Discussion in Chapter 6, and the Conclusions and Recommendations in Chapter 7.

4.0 MANIPULATIVE THERAPY

After R.I.S.S. had been tried under the scheme of PONCAT-1, an attempt was made to apply it to babies in incubators. After three attempts, the following disadvantages/objections were identified, together with a consequential course of action:-

(i) the babies could be placed in suitable postures only within the confines of the incubators, and the commencement position had, in consequence, to be one which could be easy to attain, and standardised. A free choice of posture, as with R.I.S.S., was not attainable.

(ii) the miscellaneous forms of kinesthetic, auditory, and visual stimulation were, at the least, impeded by the physical surroundings of the baby, i.e., the enclosing incubator with its necessary and attendant apparatus.

(iii) R.I.S.S. used a system of tactile stimulation with babies more mature than the subjects of this study, but associated with the various forms of stimulation as in (ii). In consequence, since a new set of techniques had to be developed in any case, in order to match the circumstances of preterm babies enclosed in incubators, the opportunity presented itself for identifying the results and outcome arising from the application of a system of tactile stimulation alone.

The sequence of thought/events, which are summarised in (i) to (iii) above, led to the discarding of R.I.S.S. as a proposition for early or very early stimulation of preterm babies. A form of manipulative therapy, more appropriate to the circumstances, was thus necessary with the attendant investigatory advantage that confusing and interactive variables could be eliminated. The resulting system, with movements and rationale owing a debt to R.I.S.S., was called MARISS; the stimulation was tactile alone, avoided looking at the baby's face (the "en face" position), was without talking, and excluded rocking.

R.I.S.S. includes, and MARISS is dependent upon systems of gentle stroking in a prescribed sequence. Since MARISS is adapted to the problem of a tiny baby in an incubator, it starts with the baby's head in the position in which he/she lies in the incubator, and is applied continuously to both sides of the body; it is a cephalocaudal system, but does not disturb the initial, prone position of the baby in the incubator. This technique was developed in Hospital-1, and then applied in Hospitals-2 and -3.

4.1 MARISS preliminary procedure and technique

Each infant lying in its incubator received 96 gentle stroking actions per day in a developed sequence; two sessions daily, each lasting approximately 10 minutes, were offered to each infant. MARISS was used in Hospital-1 three times per week during three weeks. Each infant thus received 288 gentle stroking actions per week; at the end of three weeks, these infants had each received 864 systematic stroking actions.

In Hospitals -2 and -3

Day beginning the programme	Number of stroking actions Week-1	Week-2	Week-3	Total subjects
Day-1 (24 hours)	480	960	1,440	11
Day-2	411	822	1,233	3
Day-3	342	684	1,026	5
Day-4	273	546	819	3
Day-5	204	408	612	3
	Mean stroking actions per baby = 1,072			25

4.1.1 MARISS preliminary procedure

The Chart of Appendix V has been developed for purposes of illustration and instruction. The preliminary procedure, which follows, is in the form of words in which it is given to mothers:-

(i) Start without moving your baby from his resting position, whether in incubator of not.

(ii) Before undressing your baby, gently stroke his head from the forehead to the neck (see picture No.1 of the Chart in appendix V).

(iii) Have a nappy handy in case it is needed, since the stroking often relaxes the sphincter muscles.

(iv) Make sure that your nails are smooth and cut short.

(v) Repeat the first movement six times. Steadily let your baby feel that you are there to communicate with him/her. All the other movements should be repeated three times. The stroking should last for ten minutes; if you finish before ten minutes, start again.

(vi) Use a "butterfly" but a firm touch. Do not pull the skin. It is "caress" touching, a touch of love, a very tender caring which you are showing to one so fragile, and so in need of love.

4.1.2 MARISS technique and movements

(i) Using your hand, rest your fingers gently on your baby's forehead, and stroke the entire head from the forehead to the nape of the neck. If your baby has a lot of hair, stroking it might pull and be uncomfortable; instead, place your fingertips under the hair on the scalp and stroke the skin gently. This is the only movement which you repeat 6 times.

(ii) If your baby is undressed, this is fine. If not, undo the nappy and/or other clothing very gently. Do NOT forget to warm your hands by rubbing them together. Then, using the entire surface of the palm of your hand, stroke from the nape of the neck down to the buttocks. Repeat 3 times.

(iii) Using two fingertips stroke the entire length of the spine with light, but firm circular movements from the nape of the neck down, up and down again. Feel the gentle undulation of the spinal bones.

(iv) Support the baby's leg with one hand and with the other hand, stroke the entire leg with a rotating, encircling movement.

(v) Press firmly on the sole of the baby's foot with your thumb. Do the same with both legs.

(vi) Gently turn the baby over to lie in the supine position. Using the palms of your hands and crossing your fingers on the top of the head, stroke firmly the top of the baby's head down to the chin.

(vii) Support both sides of your baby's head with your hands and, using two fingertips of each hand, stroke the centre of the forehead out to the temples.

(viii) Gently supporting the head with your hands, use your thumbs to stroke around the eyes, pressing a little more firmly on the inside of the bridge of the nose, near the inside corner of the eye.

(ix) Support the head with your hands and use your thumb to stroke gently from the bridge of the nose over the cheeks and ears.

(x) Using a fingertip, stroke around the mouth.

(xi) Gently lift the baby's head and tilt slightly back. Using your thumb, stroke over the chin and down to the throat. Stroke also both sides of the throat.

(xii) Raise your baby's arm and support it with one hand. With the other hand encircle the baby's arm and, with a rotating and encircling motion, stroke the entire arm. Press firmly on the baby's palm with your thumb as you finish the stroking of the arm. Do the same with the other arm.

(xiii) Using the palms of your hands, stroke down from the neck over the chest and abdomen. Cover as much of the skin surface with your hands as possible. Your hands should move down over the baby's tummy in one smooth gliding movement finishing after the genitalia. The whole movement is important because of the relaxation it produces. With the sphincter muscles relaxing, your baby may urinate. This is fine if it happens.

(xiv) With two fingertips, stroke the midline (called linea alba), starting at the neck down the centre of the trunk, again over the genitalia.

(xv) Support the baby's leg with one hand and encircle it with the other hand. With a rotating, encircling motion, stroke the entire leg. Press firmly on the sole of the baby's foot with your thumb.

(xvi) Place your whole hand gently on the baby's head with your fingers touching his forehead, and close to his nose, so that your baby can sense your smell (COMFORT POSITION). Rest there for a while and finally,

(xvii) Dress your baby and turn him/her to the prone position. This is the end of the stroking sequence.

MARISS is a body language. Parents were encouraged to stroke their babies as a way of "getting to know" their own particular baby (his mood, his expressions, his feelings, his/her needs). The sessions took place either mid-way between feeds, or just before feeding, or after feeding.

4.2 Assessment of the Pilot Study

4.2.1 Before treatment

Birthweights were taken from the Health Visitor's notes.

4.2.2 During treatment

Physical assessment was made weekly for eight weeks by the experimenter. Body length and head circumference were taken for the two experimental groups (PONCAR and PONCAT-1, for counselling and R.I.S.S., respectively), and for the placebo group by the experimenter. Body length was taken by laying the baby on the floor on a white sheet of paper, and stretching the legs and holding the head; this measurement was not used for analyses.

Weight was taken weekly, but at the clinic. Mothers reported this statistic to the experimenter.

Within the range of 2-months to 4-months (mean of 3-months) babies of the experimental groups above, and the placebo and non-intervention groups, were called for mental and motor assessment using the Bayley Scales of Infant Development. This assessment was not blind, but there was agreement with a check investigation, conducted blind by a colleague at the same time. However, at this period of inexperience the coefficient of reliability was not calculated.

4.2.3 During R.I.S.S. sessions (PONCAT-1 group)

During her visit with the R.I.S.S. group, the experimenter collected the recording sheets once a week for 8 weeks; these gave the state of the baby before, during and after the stroking according to the mother's perceptions, and followed the categories accepted by Dubowitz and Dubowitz, (1981). Mothers were asked to record their babies behaviour as follows:-

(i) relaxed,
(ii) content,
(iii) irritable,
(iv) crying.

4.2.4 Follow-up

There was no further follow-up with these babies.

4.3 Assessment of the Main Study

4.3.1 Before treatment

Within three days all babies had their rooting, sucking, crawling, hand grasping, and passive movements (arms and legs) assessed according to Brazelton's scores. Sucking was assessed by the insertion of the small finger (of the experimenter) into the baby's mouth. This assessment was not made at Hospital-1.

4.3.2 During treatment

The time of the last feed, with the State before, immediately after and 5-minutes after each session, according to

Dubowitz and Dubowitz (1981), were recorded. Behaviour during each session (predominant state, peak of excitement, tremulousness, startles, lability of skin colour, motor maturity, hand to mouth facility and smiles) were also recorded according to Brazelton's scores (1973).

An attempt was made to use the same observation sheet with the control group, but their unresponsiveness prevented this. However this negative feature did underline the importance of stimulation with preterm babies.

At the end of each week, and for three weeks, all babies at Hospitals -2 and -3 had the reflexes (given in the first paragraph above) assessed. Unfortunately, this assessment was not blind, due to lack of funds for an independent assessor; the results, in consequence must be viewed cautiously.

4.3.3 Post treatment

(i) At the Hospital.
All babies had their physical assessment taken (weight and head circumference). All such physical assessment was taken from the case notes from start until immediately before discharge. Babies from Hospital-1 were assessed blind in the adjusted age range of 2 to 5-months (mean = 3) with Bayley Development Scales.*

(ii) At home.
All babies of Hospital -2 and -3 were visited twice, at 40-weeks life age, and in the age range of one month, 3 weeks to 3 months. Assessment was not blind, due to lack of funds for an independent assessor; the results, in consequence must be viewed cautiously.

At 40-weeks life age the Dubowitz and Dubowitz (1981) Neonatal Behavioural Assessment Scale was used by the experimenter. The results should be regarded cautiously, since the "experiment effect" may cause bias. The experimenter attended 5 sessions observing Dr. L. Dubowitz applying the scale herself at Hammersmith Hospital during reliability tests of the Scale; it involves neurological and behavioural assessment.

Within the age range of one month, 3 weeks to 3 months the Bayley Scales of Infant Development (mental and motor scales), were used to assess development.

4.3.4 One-year follow-up

Within the age range of 11 and a half months to 13 and a half months (mean = 12 months), 10 babies of the experimental group and 10 from the control group of Hospital-3 were called back to the hospital for a blind assessment using the Bayley Scales.* 10 full-term babies at the same age range were also called to the same hospital, and had the same blind assessment.

Due to lack of funds, babies of Hospitals -1 and -2 were not followed-up to this extent.

4.3.5 Two-years follow-up

The same babies as in sub-section 4.3.4 were called back for assessment. Within the age range of 23 to 30 months (mean = 24 months), the mothers were requested to bring their babies back to Hospital 3.

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* Bayley Scales are standardised and they are adjusted for age.

4.4 The Complementary Study

MARISS was the tool developed during the period of this research, for the purposes of the research itself; the main body of the results depend upon its consistent application. These results (Chapter 5) and the Conclusions and other indications derived from them (Chapter 6 and 7), together with the experience gained with MARISS led, in the last few months of the work, to the formulation of a yet more comprehensive scheme of treatment for babies. This treatment has been given the name TAC-TIC, the acronym for "Touching and Caressing - Tender in Caring".

TAC-TIC is neither speculative, nor a proposal. Its procedures, technique and movement have been established, and an assessment was made following the (MARISS dependent) study described in this thesis. This assessment thus followed the major study, and has been classified into:-

(i) Before TAC-TIC,

(ii) During TAC-TIC,

(iii) Post TAC-TIC,

(iv) 6-months follow-up.

TAC-TIC, albeit a refined outcome of the research rather than a final stage of it, could not be part of the original methodology. However, as a comprehensive practical outcome, TAC-TIC completes the thesis, and is accordingly described in Appendix VII together with the results of the first 6 months of its application; a chart of TAC-TIC techniques is given in Appendix VI, from which it may be compared with MARISS as given in Appendix V.

5.0 RESULTS

The data analyses for the pilot study (full-term babies), and for the main study (preterm babies), were conducted separately.

5.1 Pilot Study

The three months (mean) variables were analysed, by the raw data; the variables were performance on the Bayley Scales of Infant Development (MDI and PDI). Table 5.1 shows the birthweight for the full-term babies.

Table 5.1 - Birthweight Raw data for the Pilot Study (Full-term Babies).

	GROUP	N	Birthweight (kg) Raw data	
1	PONCAT-1 (R.I.S.S.)	4	S1* 2.5 S2 3.1	S3 4.0 S4 4.1
2	PONCAR (Counselling)	3	S5 4.0 S6 3.5	S7 3.5
3	Placebo	2	S8 4.3	S9 3.0
4	Control	3	S10 3.3 S11 2.7	S12 2.7

Mothers' ages were not recorded

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* S1, S2, etc. denote subjects

5.2 Main Study

The main study could conveniently be divided into ten sections:

5.2.1 The mothers' variables (type of delivery and parity) and the parents' variables (race, socio-economic status (SES)), were analysed comparing groups with Chi Square. Mother's age was analysed comparing groups with a one-way ANOVA.

5.2.2 A three-way analysis of variance, by hospital, by group membership, and sex was calculated. These variables were birthweight (BW), birthlength (BL), estimated gestational age (GA), head circumference (HC), and Apgar Score at 1 and 5-minutes (AP1 and AP5), respectively.

There were hospital effects with BW, GA, HC and AP1, hence it was decided that hospitals should be taken into account for further analysis. Hospital-1 was the significant one, thus it was analysed separately against hospitals -2 and -3 taken together.

5.2.3 Difference in weight at discharge and Mental and Motor Development Index (MDI and PDI) were calculated with a two-way ANOVA (by hospital and by group).

5.2.4 5 reflexes which normally appear at birth with full-term healthy babies, namely, rooting, sucking, hand grasp, crawling, and passive movements of legs and arms were analysed with a one-way analysis of variance by group membership. Hospitals were not taken into account because these variables were not assessed at Hospital -1. The reflexes were recorded at birth, and at 1, 2 and 3-weeks.

5.2.5 The infants' behaviour during each stimulation session, over a period of 3 weeks, was analysed using:-

(a) mean and standard deviation,

and (b) two-way (by group GA and by period:- weeks 1, 2 and 3) repeated measure ANOVA were calculated.

The variables were:-

(i) State before, during, immediately after and 5 minutes after each session,

(ii) Peak of excitment,

(iii) Tremulousness,

(iv) Startles,

(v) Liabiity of skin colour,

(vi) Motor maturity,

(vii) Hand to mouth facility,

(viii) Smiles.

At Hospital-1 these variables were not recorded. However "state" during and immediately after the stimulation was recorded according to the categories of "sleeping", "drowsy", "alert", and "crying".

An attempt was made to record the emotion of the baby in response to tactile stimulation (MARISS). The face of the baby was carefully observed by the investigator, and an entry made at the bottom of the recording sheet according to "content", "relaxed", or "irritated".

The babies' movements were also indicators of emotion on receipt of stimulation; the extension of the baby's body and limb stretching, and the delectable sound of "purring" were interpreted as indicators of pleasure on receipt of tactile stimulation. Hospital-1 results were analysed separately.

5.2.6 The variable total food intake at Day-7 was analysed by comparing groups with a one-way ANOVA by group membership. At Hospital-1, this variable was not recorded.

5.2.7 The variables at discharge (weight, head circumference) were analysed, comparing groups with a two-way ANOVA by Hospital, and by group membership.

5.2.8 The 40-weeks variables (at home) were analysed comparing groups with a one-way ANOVA by group membership*. These variables were:-

(i) Habituation (light and sound).

(ii) Movement and tone (posture, tone in the limbs, arm recoil, arm traction, leg recoil, leg traction, and popliteal angle).

(iii) Trunk and neck tone (head control, head lag, and ventral suspension).

(iv) Normal and abnormal movements (head raising in prone, arm release in prone, spontaneous body movement, tremours, and startles).

(v) Reflexes (palmar grasp, rooting, sucking and walking).

(vi) Neurobehavioural items (auditory and visual orientation, alertness, peak of excitement, irritability, consolability and cry).

5.2.9 The 1 month and 45 days, to 4 months and 45 days (mean= 3 months) variables were analysed comparing groups with a three way ANOVA by Hospital, by group membership and by sex. These variables were performance on the Bayley Scales of Infant Development (MDI and PDI).

5.2.10 10 and one-half months to 13 and one-half months (mean= 12 months) variables were analysed comparing groups with a one-way ANOVA by group membership only (Hospital -1 was very distant from the other two, and this limitation arose from entirely practical travel considerations). These variables were MDI and PDI.

5.3 Interdependence of Variables

The broad goal of the research was to compensate, and/or establish techniques for compensation for the adverse effects of some environmental and/or genetic variables, as well as to enhance the development of the babies. Such babies are potentially at risk for

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* At Hospital -1, these variables were not recorded.

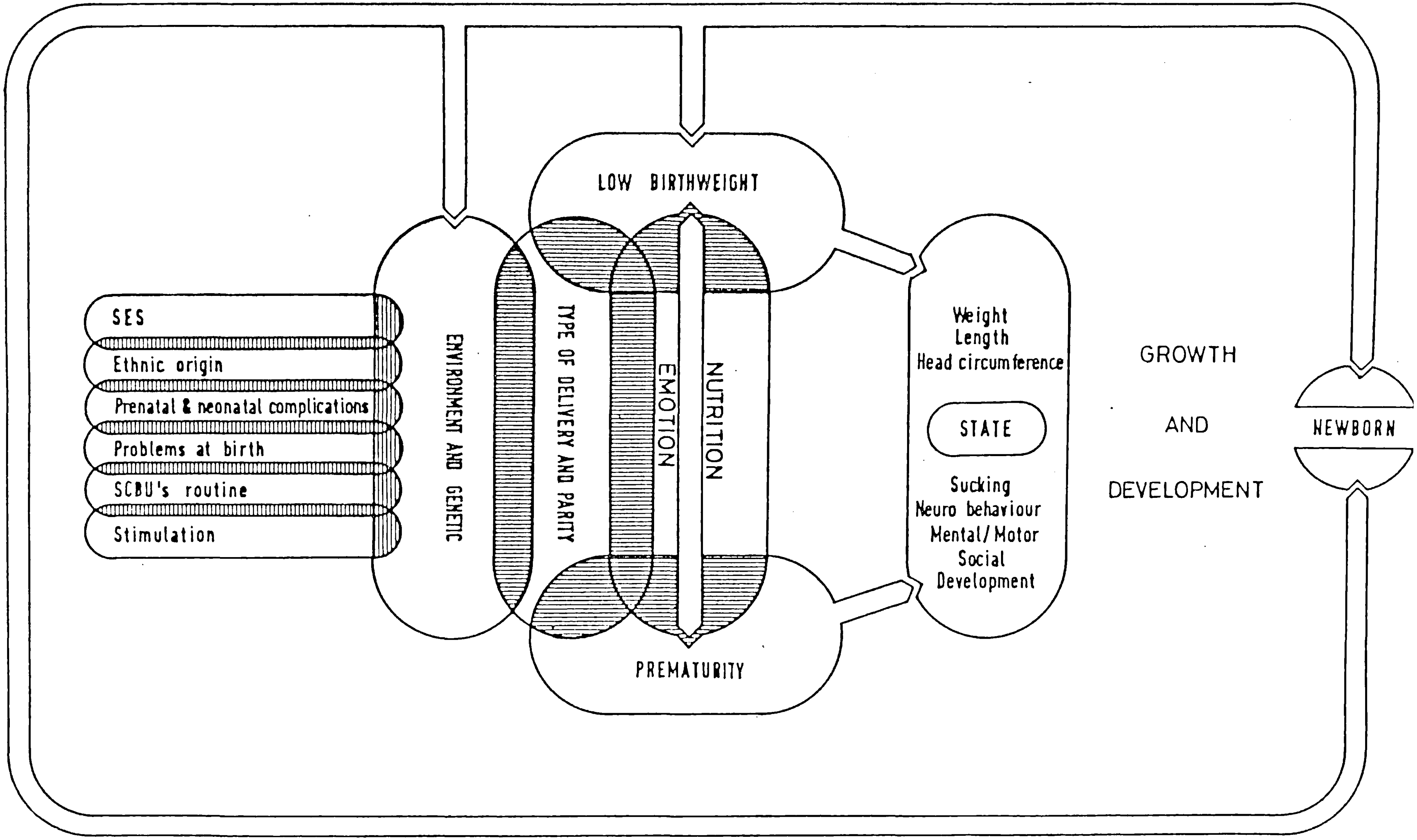

FIGURE : 5.1 VENN DIAGRAM

"intact" survival; it was assumed from the outset that providing support, and an adequate environment for them, was likely to ameliorate their disadvantageous conditions at birth.

Fig. 5.1 is a Venn diagram for expressing the relationship involved in the results of this research, and generally illuminating the problem of interaction of the many variables. The diagram is only qualitative; overlapping areas express the idea of a relationship between the (overlapped) entities. Of particular importance is the LBW condition. This condition generates an apathetic state in which there is little response by the infant to the environment which, in its turn, has the effect of reacting in such a way as to offer cumulatively less stimuli. The effect of any stimuli is minimal unless it is consciously directed; conversely, the lack of any two-way transaction might have negative effects on the development of the cognitive structures, the evoking of which should lead to learning.

The promotion of neurobehavioural and psychological development of LBW and full-term babies by early tactile stimulation is the major objective of the work described in this thesis. To facilitate appreciation of the effects of this intervention programme on growth and development of both full-term and preterm babies, Fig. 5.1 attempts to portray the pattern of interaction (overlapping) between the many variables (and groups of variables). These variables are given in section 5.2, and in (i) to (iv), inclusive, below.

"Environment" is very significant, and incorporates the following variables:-

(i) race,

(ii) socio-economic status (SES).

(iii) medical variables (type of delivery, primapara problems at birth, perinatal and neonatal complications).

(iv) hospital variables (discharge policies, special care routines).

Finally, in an attempt to cast light on the many variables involved in the studies, films were made. Five super-8 mm films were taken during different stimulation sessions, by the investigator and by a mother, with different infants, in the incubator and in the cot; these were analysed in an attempt to identify emotions of the preterm baby by facial expressions. Slides were also taken and the pictures analysed.

5.4 Sample distribution for the Pilot-study

The subjects of the pilot-study (full-term babies) had similar birthweight as is shown in Table 5.1. Social class II was predominant and all parents were Caucasian.

5.5 Characteristics of the parents

Despite the sample not being matched according to SES, in order to avoid attrition of the sample, the subjects were equally distributed and both groups were predominantly at SES III (see Table 5.2).

This result supports the hypothesis of Stratton (1977) and of Kuslick and Blunder (1974) that mildly subnormal subjects, without any other abnormalities (neurological, biochemical or chromosomal), were confined mostly to the lower social classes. Table 5.2 shows that there were no significant differences in race, SES, parents' age and primipara variables between the experimental and the control groups amongst the three hospitals.

Table 5.2 - Characteristics of Parents of the low-birthweight infants (see Appendix VIII)

Mothers/Father		Race (Percentage)		Primapara		Age		Occupation***	
		C.*	N.C.**	Mean	S.D.	Mean (years)	S.D.	Mean	S.D.
Experimental (MARISS)	Mothers	61.3	38.7	1.7	1.0	28.3	6.6	III	0.5
	Fathers	54.8	45.2	-	-	-	-	2.7	0.6
Control (non-MARISS)	Mothers	68.6	31.4	1.6	1.1	27.2	5.1	III	0.6
	Fathers	67.6	32.4	-	-	-	-	2.9	0.6

* Caucasian

** Non-Caucasian

*** From the "Classification of Occupations and Coding Index - 1980"; published by the Office of Population Census and Surveys, H.M.S.O.

The age range for the mothers of both groups was 16-40, with no significant difference in the mean age between those of the experimental and control groups. The infants were predominantly first-borns. There were no differences in the mean age of the mothers between the 3 hospitals.

5.6 Differences in Infants' variables measured at birth

Birthweight (BW), Gestational age (GA), and the "status" of having no ventilation treatment beyond day-3 were the three criteria for selection of the infants of this study (as mentioned in Chapter 3). Indirectly, the last criterion would indicate the grade of problems at birth and perinatal complication. The hospitals showed significant differences on the two former baseline variables (BW and GA), as well as on head circumference (HC), and Apgar Score at 1-minute (AP1), as shown in Table 5.3. Looking at the distribution of the 3 hospitals in terms of mean and standard deviations (Table 5.4), the infants of Hospital -1 showed greater values for these variables; this suggests that, as far as status is concerned, the babies from Hospital -1 were in a better condition at birth. Hence it was decided that the hospital, as a variable, should be taken into account for further analyses. However, Hospitals -2 and -3 were not statistically different on the baseline variables; ergo it was decided that they were recruiting from the same population, and that they should thereafter be analysed as one hospital.

According to the case notes, all infants amongst the three hospitals had experienced much the same level of problems at birth, and similar perinatal and neonatal complications; the raw data of these conditions is given in Table 5.5. This may be confirmed by the fact that none of the babies had ventilation beyond day-3, as well as by the high mean Apgar Score at 5-minutes. Apgar score is well established; the lower the performance on a scale of 0 to 10, the poorer the condition at birth. It is not within the scope of this work to discuss the value of the Apgar score for prediction of later abnormalities; however it is accepted as a reliable indicator of the

Table 5.3 - Results of 3-way Analysis of Variance: Differences in Infants' Variables at Birth

Variables	Groups		Hospital		Sex		Intervention	
	F	Sig. of F	F	Sig. of F	F	Sig. of F	F	Sig. of F
Birthweight (BW)	0.82	0.37	4.81	.03	.36	.55	.02	.87
Birthlength* (BL)	-	-	-	-	-	-	-	-
Gestational Age (GA)	.00	.97	7.79	.01	3.58	.06	.28	.60
Head Circumference (HC)	.84	.36	6.19	.02	.93	.34	.00	.95
Apgar Score at 1 min (AP1)	.26	.61	6.58	.01	.01	.91	.21	.64
Apgar Score at 5 mins (AP5)	2.33	.13	.86	.36	1.73	.19	.76	.39

* Birth length was not recorded for Hospital-1 hence it does not appear on the three-way ANOVA.

Table 5.4 - Differences in Infants' Variables amongst hospitals and groups as measured at Birth.

Variables	Intervention						Non-Intervention					
	N = 06 H-1		N = 06 H-2		N = 19 H-3		N = 06 H-1		N = 07 H-2		N = 22 H-3	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
BW (kg.)	1.72*	0.19	1.54	0.30	1.45	0.30	1.75	0.20	1.55	0.38	1.54	0.38
BL (cm)	-	-	41.12	3.57	42.46	3.16	-	-	41.85	3.62	41.55	3.28
GA (weeks)	33.67	2.25	31.50	1.76	32.16	2.28	33.33	1.97	31.43	2.07	31.82	1.97
HC (cm.)	31.00	0.63	28.90	1.71	29.04	1.60	30.00	1.00	29.21	1.98	28.64	2.37
AP1	7	2	7	2	6	2	8	2	5	2	5	2
AP5	9	1	9	1	9	1	9	1	8	1	8	2

* BW, GA, HC and AP1 are significantly different ($p < 0.05$) for Hospital -1 against Hospitals -2 and -3.

Table 5.4(a) - Differences (T values) in Infants' variables amongst hospitals and groups by condition small - for gestational age (SGA) and appropriate - for gestational age (AGA) as measured at birth.

Variables	Experimental								Control							
	Hospital -1				Hospitals 2,3				Hospital -1				Hospitals -2,3,			
	SGA(n=2)		AGA(n=4)		SGA(n=9)		AGA(n=16)		SGA(n=2)		AGA(n=4)		SGA(n=6)		AGA(n=23)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
BW (Kg.)	1.6	0.3	1.8	0.1	1.3	0.1	1.5	0.3	1.7	0.4	1.8	0.1	1.3	0.1	1.6	0.4
BL (cm.)	-	-	-	-	42.0	4.2	42.3	2.7	-	-	-	-	39.0	1.1	42.6	3.3
GA (weeks)	35.5	2.1	32.7	1.9	32.0	2.0	32.0	2.2	34.0	2.8	33.0	1.8	33.0	1.7	31.4	1.9
HC (cm.)	31.0	0.0	31.0	0.8	28.4	1.5	29.4	1.6	29.0	0	30.2	0.9	27.2	2.5	29.3	1.9
AP1	7	3	7	2	5	2	6	3	8	1	8	3	6	3	5	2
AP5	9	1	9	1	8	1	9	1	10	0	9	1	8	3	8	2

Not significant at p $\angle$ 0.05.

Table 5.5 - Raw data for Problems at Birth, Perinatal and Neonatal Complications

Problems at Birth, Perinatal and Neonatal Complications	Hospital-1		Hospital-2		Hospital-3		Total
	Inter-vention	Non-Intervention	Inter-vention	Non-Intervention	Inter-vention	Non-Intervention	
Ante-partum Haemorrhage	0	0	0	0	1	0	1
Foetal Distress	0	0	0	1	0	1	2
Prolonged ROM	0	0	2	0	4	3	9
Birth Asphyxia	2	1	0	0	2	2	7
Resuscitation	0	0	0	0	1	2	3
R.D.S. (mild)	1	2	3	2	2	6	16
Infection	2	0	0	0	3	2	7
Hypoglycaemia	0	1	0	0	1	0	2
Hypothermia	1	0	0	0	1	0	2
Jaundice	4	3	0	2	9	14	32
Hyperbelin	0	0	0	0	2	1	3
Anaemia (mild)	0	0	0	0	1	0	1
Bradycardia	0	0	0	0	2	5	7
Apnoea	0	0	0	0	3	4	7
Thallacaemia	0	0	0	0	0	1	1
Hypocalcaemia	0	0	1	0	0	2	3
Total	8	7	6	5	32	43	103

Binomial test for these two differences was calculated:-

= -1.555
not significant

following at birth:-

(i) Appearance (color),

(ii) Pulse (heart rate),

(iii) Grimace (reflex irritability in response to stimulation of the sole of the foot),

(iv) Activity (muscle tone),

(v) Respiration (respiratory effort).

Perinatal complications have been consistently related to later physical and psychological development, when combined with and sustained by persistently poor environment conditions (Werner, Bierman and French, 1971; Beckwith, 1976). However, the view taken here is that greater SES, and a higher level of education of the parents may decrease the risks of a poor environment, but do not guarantee that the needs of the "at-risk" infant are satisfied; in fact, lack of appropriate stimulation may happen in very rich environments. It is evident that babies born with disadvantages will be less able to cope with those adverse effects of inappropriate environments which are not "attuned" to their needs.

The visits "at home" which were undertaken for the pilot study (full-term), and the main study (Hospital-2 and -3) showed that none of the subjects could be considered to be living in a very poor house. The babies were visited during winter as well as summer time; the sometimes-claimed effects of seasonal birth were not apparent amongst the groups. The infants were mostly first born.

5.7 Reflexes at birth

Hospital -1 was assessed on rooting, sucking, hand grasp, crawling, legs and arms movements. A one-way ANOVA by group membership compared the group differences. There were not significant differences in reflex performance (as given in Table 5.6) between the two groups; they showed either absence or weak response at birth. Thus it was concluded that the infants had the same neurological "status" at birth as far as the chosen 5 reflexes were concerned. This is an expected result, since it is well known that LBW babies have weak performance on reflexes compared with the well-equipped, healthy, full-term baby.

TABLE 5.6 - One-way ANOVA by group membership, for five Infant Reflexes measured at Birth.

	Reflexes	F	Significance
1.	Rooting	0.39	0.53
2.	Sucking	1.01	0.32
3.	Crawling	1.62	0.21
4.	Hand grasp	0.02	0.89
5.	Passive Movements		
	Arms	0.15	0.69
	legs	0.01	0.91

In the work described in this thesis, there is particular concern with sucking, because of the obvious implications which this reflex has on feeding. Lipsitt and Werner (1981, p.45) stated that "intellectual development, according to Piaget (1952), and social development, according to Freud (1938), have their foundation in the sucking response of the infant". With such authoritative emphasis, the importance of sucking has increasingly attracted the attention of research workers in this area. Sucking has been observed as early as 26 weeks GA, but only weakly; it has been pointed out (Shosenberg, 1980) that sucking action is not strong enough for drinking until 32-34 weeks.

As the research proceeded, it was suspected that particular MARISS movements were conducive to better sucking performance. Accordingly attention was paid to the question of how to evoke a sufficiently good enough sucking performance in order to facilitate the very LBW babies to start the bottle and/or the breast earlier. Sucking, in an opinion derived from the results of this research, could be exercised and babies would acquire competence to suck strongly enough for drinking before 32-weeks; alternatively, the exercise would guarantee that sucking would develop strongly enough for drinking at that age. Per contra, privation of sucking may well extend the time interval before babies start bottle or breast feeding, thus extending the period of tube feeding; such an eventuality may cause physiological effects with the babies, and psychological ones on the parents, as discussed later in this Chapter.

It is known that the incapacity of the preterm babies for coordinating swallowing, sucking and breathing is one of the reasons for tube feeding. Swallowing is seen even earlier than 26-weeks, but it is not well developed until 34-weeks. Would the exercise of sucking enhance the development of swallowing? If this should be so, the implications of privation of sucking may be more serious than it has been thought hitherto.

5.8 Hospital -1: behaviour during the stimulation sessions of week-1

The observed results here (and likewise for Hospitals -2 and -3) were extensive, and in consequence they have been itemised below for reference. It is noteworthy that the results from observation, as distinct from test, usually require some immediate explanation and/or elucidation, both here and in section 5.9, following.

5.8.1 The subjects of Hospital -1 did not have a standardized assessment of their behaviour during the stimulation session.*

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* The responses of the babies at Hospital -1 alerted the investigator of the necessity for a standardized procedure for these variables; this was adopted for Hospitals -2 and -3.

At Hospital 1, the observation sheet recorded which of the States (sleeping, drowsy, alert, crying) was occupied by the baby before, during, and immediately after the stimulation session; predominantly, the babies were sleeping before, drowsy or alert immediately after, and drowsy or alert during the stimulation session. This result indicates that the stimulation establishes a state of "readiness" to the outside world. It became noticeable and of great interest that if the caretaker is also ready to transact with the baby in an appropriate way, they may have a wonderful "play time", for 5-minutes or even longer.

5.8.2 The result in 5.8.1 also showed that the babies did not become irritated because they were awakened; furthermore, after the stimulation session they went to sleep again contentedly, and there was no need for the caretaker to think that the baby "would not settle". If the baby was hungry, he would feed better following stimulation, as was noticed by one mother.*

5.8.3 It was recorded in the "Comments" column that all babies showed a face of "content". This was noted by many observers, who made remarks such as, "He likes it", "He seems to enjoy it", "He looks relaxed".

5.8.4 Usually during the session, the babies extended their bodies and their limbs; this is hereafter described as "stretching". During the stroking sessions, the babies stretched noticeably whilst lying on their backs.

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* This particular mother mentioned that she would stroke her baby before his feed, because "this was helping her baby to feed better". She was a single mother, 19 years old, and had a defined profession.

5.8.5 Vocal response was also observed with all babies, but not in a uniform way. All babies produced a sound described hereafter as "purring"; this highly agreeable soughing is a significant indication of animal pleasure, and testified that babies found the treatment agreeable; the importance of pleasure to the development of the infant is discussed later in this chapter.

5.8.6 The result in 5.8.5 suggests that MARISS produces change in the (very) LBW infant, and also evokes the pleasure which occupies an important role in establishing a dyadic, or a tryadic transaction. It is quite reasonable to assert that the contentment responses will result in more attachment.

5.9 Hospitals -2 and -3: behaviour during the stimulation sessions of week-1.

A standardized assessment of behaviour (Brazelton, 1976) was used during the stimulation sessions for the infants at Hospitals -2 and -3 (Table 5.7). The sub-sections below identify the various categories of the Brazelton assessment.

5.9.1 State before stroking.

The babies were observed twice each day for five days during the first week; they were observed to be at state 1.6. The time of observation was either,

(i) immediately before feeds,

(ii) in the mid-period between feeds,

or, (iii) immediately after feeds.

This result (state 1.6) extends into the category of "Sleep states", and suggests no spontaneous activity and a low

TABLE 5.7 - Infants' Behaviour (Hospitals -2 and -3) during the first week of stimulation (Mean and Standard Deviation)

	VARIABLES	Experimental group (N=25)	
		Mean	Standard Deviation
1.	State before	1.6	0.6
2.	State during	3.6	0.8
3.	State immediately after	3.4	0.9
4.	State 5-minutes after	2.5	0.8
5.	Peak of escitement	4.5	1.0
6.	Tremulousness	1.5	0.7
7.	Startles	1.7	0.7
8.	Lability of skin colour	2.2	0.5
9.	Motor maturity	3.6	0.6
10.	Hand to mouth facility	2.3	0.9
11.	Smile	0.8	1.7
12.	Stretching	1.2	0.4
13.	Purring	1.2	0.4

activity level; see Pictures 5.1 (a) and 5.1 (b)*.

5.9.2 Predominant state during stroking

This scored a mean value of 3.6; this is in the category of "Awake States", and falls between "Drowsy..." and "Alert...".

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* Unfortunately no picture was satisfactorily developed of the baby before the session; the one shown here is of the second movement of MARISS, and it is still possible to identify a similar result (State 1.6).

Picture 5.1 (a) State before stroking
Infant born with 31 weeks
Session nº 10 (32 weeks)

Picture 5.1 (b) State before stroking
Infant born with 31 weeks
Session nº 10 (32 weeks)

This implies that the babies had attained a condition suited to the tactile stimulation which they were then receiving; see Pictures 5.2 (a) and 5.2 (b).

5.9.3 State immediately after stroking

After each session, the mean recorded figure was 3.4; this is within the category of "Awake States". State 3, which described the baby as "drowsy, ... eyes may be open or closed", may well be a suitable tool for assisting two- and three-way interaction. It was noticed, and recorded on film*, that the parents may use the stimulation session to talk to each other about the improvement to their babies; see Pictures 5.3 (a) and 5.3 (b).

5.9.4 State 5-minutes after stroking

The situation 5 minutes after termination of each session was also recorded. The mean value was 2.5, a figure indicating the borderline between the states of "Light sleep with eyes closed ..." and "Drowsy...". This suggests that the stimulation session had not been overbearing, and that there had not been overloading as mentioned in the literature (Korner, 1981). In plain words,

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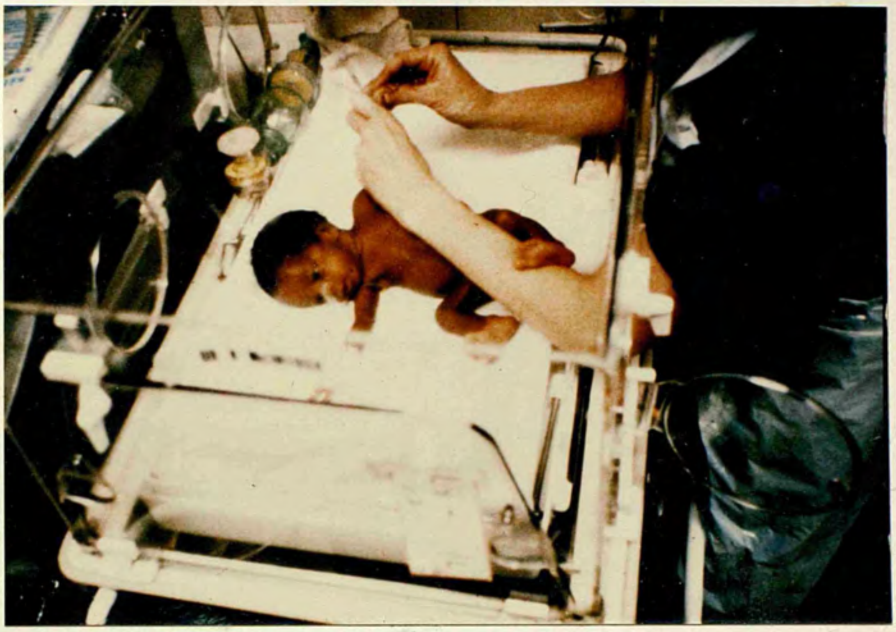
* The arrangement here was that the father always "stroked" his baby girl whilst the mother "stroked" her twin son. Such a session was filmed. Sometime during the session, the baby girl sniffed, and the mother immediately took a tissue and walked to the girl. Later in the session, there was interaction between parents when a discussion ensued as to which of the two babies was the taller? The film suggests that the responses of the babies to MARISS, and the interest of parents in the outcome of the activity, identifies MARISS as evoking visual and auditory stimulation. These two subjects were discarded to avoid bias, since their mother became enthusiastic to stroke them after seeing the response of another mother's baby to MARISS. Although this was regrettable from the standpoint of accumulating research evidence, it was very encouraging at the time as indicating the beneficial effects of MARISS, as it had then been developed.

Picture 5.2 (a) State during stroking.
Infant born with 31 weeks
Session nº 10 (32 weeks).



Picture 5.2 (b) State during stroking
Infant born with 31 weeks
Session nº 10 (32 weeks)

Picture 5,3 (a) State immediately after stroking
Infant born with 31 weeks, Session nº 10 (32 weeks)

Picture 5,3 (b) State immediately after stroking
Infant born with 31 weeks, Session nº 10 (32 weeks)

the babies had not been overstimulated; one mother commented that if her baby was sleeping, MARISS had the effect of awakening and causing her baby to interact with her, and with the environment. Equally however, if the baby is irritable, MARISS has been found to have a calming effect, a valuable supplementary feature (see Picture 5.4).

5.9.5 Peak of excitement during stroking

Peak of excitement measures motor excitement; the mean recorded figure was 4.5, which implies that the babies were available to the outside world and responding to the stimuli. Through their skin they were responding to their caretaker; it might be said that an infant uses stimulation to quieten itself, or to maintain a quiet state.

5.9.6 Tremulousness during stroking

Tremulousness is a measure of irritation or depression of the central nervous system, and may occur for metabolic reasons; since it may be a sign of immaturity, it becomes one more way of indicating all these characteristics. The mean figure recorded was 1.5, which indicated that no tremors or tremors-only-during sleep were noted during the MARISS.

5.9.7 Startles during stroking

The mean figure for Startles (total body movement) was 1.7; this is intermediate between no Startles being noted, and no Startles as a response to the examiner's attempts to set off a Moro reflex only. This result is important in suggesting that MARISS is not a disturbing stimulus.

5.9.8 Lability of skin colour during stroking

Lability of skin colour measures the chances of colour and vascularity which take place during the treatment. The mean

Picture 5.4 State 5 minutes after stroking. Infant born with 31 weeks. Session n^{o}. 10 (32 weeks).

figure obtained was 2.2, thereby indicating good colour which changed only minimally during treatment. Absence of mild colour changes, which are common whilst a baby is normally being manipulated, again suggests that MARISS did not disturb the babies. It is not possible to assert more than this. Marked, but short term, temperature changes are commonly observed with short gestation age babies, since they are not necessarily fully adjusted to extra-uterine temperature changes; however these babies are in the constant environment of incubators.

5.9.9 Motor maturity during stroking

Motor maturity measures motor responses, both spontaneous and elicited, which are assessed throughout the treatment. The mean figure obtained was 3.6, which implies only occasional jerky movements with predomination arcs to angles of 45 degrees; there was no overshooting, which is characteristic behaviour in short gestation age babies.

5.9.10 Hand-to-mouth facility during stroking

Hand-to-mouth facility is an inborn reflex, and seems to be a response to stroking the cheek, or the palm of the infant's hand. The mean figure was 2.3, which indicates brief swipes towards the mouth area, either once only with no real contact, or hand brought to the mouth with contact but no insertion. The result suggests that MARISS encourages the inborn reflex, which is very important for later feeding.

5.9.11 Smiles during stroking

Smiles were present with only 28 per-cent of the babies. The mean figure was 0.8, and they smiled in response to tactile cues rather than to auditory and/or visual cues.

5.9.12 Stretching during stroking

Stretching during stroking as already defined in sub-section 5.8.4, was clearly noticeable in all babies, to differing degrees during the first week and increasingly during the second and third weeks. The fact that MARISS evokes this response during the first week in babies born as early as 27-weeks GA appears to be of importance; in particular, extension of the body and limbs are well-known voluntary responses with beneficial results to the spine. Noting the animal kingdom for instance, that most supple group, the cat family with their kittens, can be found stretching their bodies regularly and frequently from birth onwards.

5.9.13 Purring during stroking

Purring, as already defined in sub-section 5.8.5, was a response obtained as early as 27-weeks GA during the first week of stroking, and increasingly during the second and third weeks. It was not a uniformly obtained response however. As already commented in this thesis, purring not only is indicative of pleasure experienced by the babies, but is also a social behaviour; the first obvious consequence of this latter is that it elicits immediate responses from the caretakers with expressions such as, "what a nice noise!".

5.10. Differences in weight during the first week.

As discussed in Chapter 2, weight is usually lost during the first week by all babies, and may not start to be gained until as late as 2-3 weeks. The daily charting of weight gain of preterm babies has been shown to have one obvious advantage and at least one other which, although less obstrusive has substantial ramifications. These are:-

(i) to show how the infant is thriving,

and (ii) to help parents psychologically, and in particular to assist mothers to cope with, or overcome a feeling of failure and anticipatory grief (Caplan, Mason and Kaplan, op. cit.).

Fig. 5.2 shows the percentage mean for weight loss or faster weight gain during the first week according to Hospitals, and according to groups. The intervention group, regardless of Hospital, lost less weight than the non-intervention group.

In both Hospitals-2 and -3, the stimulated (intervention) group lost less body weight, as shown in Table 5.8.

At Hospital-1, surprisingly, the difference is not statistically significant although the stimulated group does lose less body weight during the first week. At Hospital -2 and -3, again the intervention group lost less body weight during the first week than the non-intervention group, the result being significant (< 0.008); this confirms that MARISS does have an effect on weight gain, the babies also regaining their birthweights quicker than those of the non-intervention group (see sub-section 5.12.2 later). Fig. 5.2 gives a more succinct view of the distribution of weight loss according to Hospital and group membership, and according to group membership only (sub groups MARISS-1, with stimulation starting before day-3, and MARISS-2, with stimulation starting after day-3, but before day-5). If Hosppitals are not taken into account, the difference between the intervention and non-intervention groups is significantly (< 0.02) in favour of treated infants; this suggests that stimulation by stroking after birth for (very) low birthweight infants is beneficial.

Treated infants were divided into two groups:-

MARISS-1 with stimulation sessions starting before day-3 and MARISS-2 with stimulation sessions starting at day-3 but within day-5.

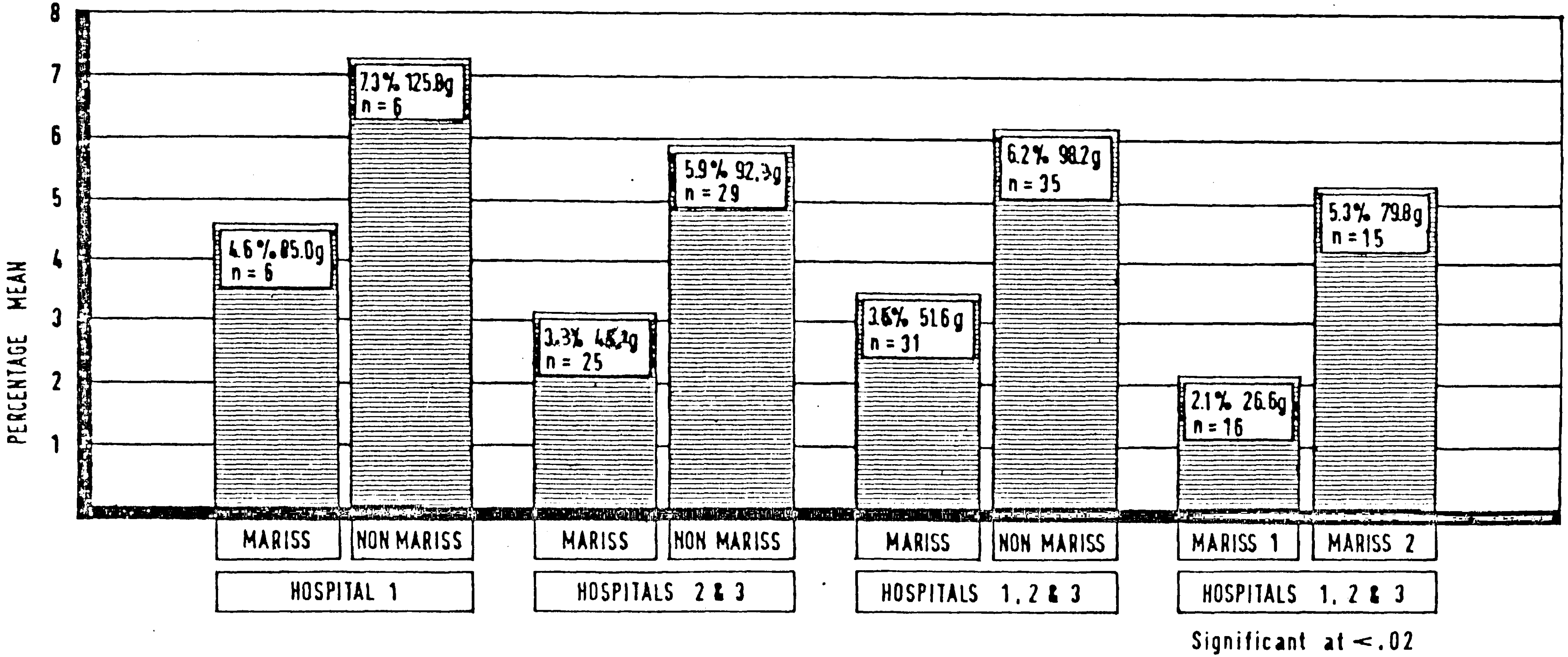


FIGURE: 5.2 PERCENTAGE MEAN FOR WEIGHT LOSS DURING THE FIRST WEEK ACCORDING TO HOSPITALS AND GROUPS.

Table 5.8 - Differences in Infants' variables (weight loss) at week-1, expressed as weight at day-7 less birthweight (t-values)

Groups	Hospital -1				Hospitals -2 and -3			
	Mean (gm.)	Standard Deviation	N	%	Mean (gm.)	Standard Deviation	N	%
Intervention	85.0*	109.3	6	4.6	45.2**	46.0	25	3.3
Non-Intervention	125.8	53.5	6	7.3	92.3	77.3	29	5.9
Intervention -1	-	-	-	-	35.1***	38.0	14	2.4
Intervention -2	-	-	-	-	58.0	53.0	11	4.5

* Not significant

** $p < 0.008$

*** Not significant

This result requires further investigation*, and there is also a question of duration; it may well be suggested that 5 days a week stimulation (10 sessions per week), with a complete stroking routine, helps the babies to lose less weight.

Since the question remained of whether "critical periods" for intervention exist, or not, the stimulated group** was split into two sub-groups, as follows:-

(i) those infants who were given VERY early tactile stimulation, i.e., within two days.

and (ii) those infants who were given early tactile stimulation, i.e., within five days but later than two days.

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* There is lack of knowledge of how preterm infants deal with either sensory deprivation or sensory overload (Korner, 1981), but studies with older individuals suggest that both under- and over-stimulation have a disruptive and disorganizing effect on the psychological and physiological functiong of the organism (Frankenhaenser and Johansson, 1974, in Korner, 1981). At minimum, the scope for immediate further research is twofold:-

(i) there is controversy over the timing of intervention, it being asserted that some research results suggest that late intervention can be as efficacious with preterms as intervention incorporating the neonatal period (Gottfried, in Smeriglio, 1981).

(ii) there are recent views which appear to be at variance with the sensible results of the work described in this thesis; whatever the outcome, at the very least, these standpoints tend to obfuscate the different roles and significance of the variously available systems of stimulation. To quote Gottfried, op. cit., "I concur with Drs. Korner and Barnard that the most promising types of stimulation in terms of ameliorating and enhancing development in young infants would come under the rubric of kinesthetic-vestibular or motion stimulation."

** The variable "Hospital" was not taken into account for this analysis.

Fig. 5.2 and 5.5, with Table 5.8, show that the VERY early stimulated group lost less body weight than the early stimulated groups; this suggests the likelihood of a "critical period" for intervention with low birthweigt infants. The fact that later intervention programmes are also beneficial does not invalidate the necessity for VERY early intervention with infants "at risk" (in this context, see also the quotation by Gottfried in the penultimate paragraph of this section).

It could also be argued that the VERY early stimulated group (N=16) had better conditions at birth (BW, GA, HC, BL, AP1 and AP5) than the early stimulated group (N=15); this is not so, as is demonstrated in Table 5.9. There was also no difference in parents' characteristics (race, SES, mother's age, and parity).

TABLE 5.9 - Differences in Infants' Variables (MARISS-1 and MARISS-2), as measured at birth

	Variables	Group	
		MARISS-1 (N=16)	MARISS-2 (N=15)
1.	Birthweight (kg.)	1.53* (0.27)**	1.52 (0.33)
2.	Birthlength (cm.)	42.95 (2.85)	40.86 (3.53)
3.	Gestation Age (months)	32.44 (2.39)	32.20 (2.11)
4.	Head Circumference (cm.)	29.45 (1.51)	29.45 (1.85)
5.	Apgar Score, AP1	6.31 (2.36)	6.13 (2.44)
6.	Apgar Score, AP5	8.94 (1.06)	9.07 (1.22)

* Mean

** Standard Deviation

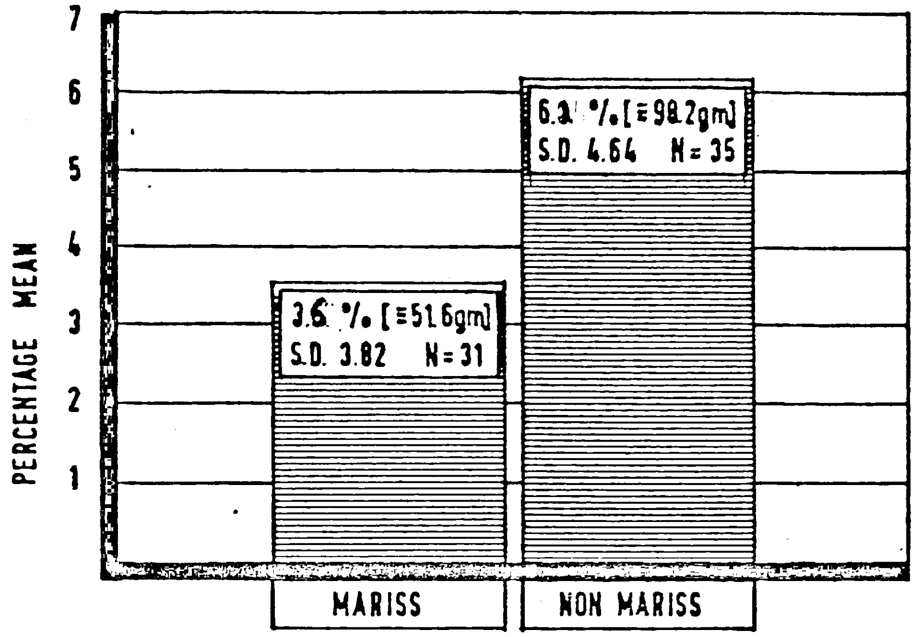

FIGURE: 5.3 MEAN (GRAMS AND PERCENTAGE) OF WEIGHT LOSS DURING THE FIRST WEEK OF MARISS, AND NON-MARISS TINY BABIES. ($p < .02$)

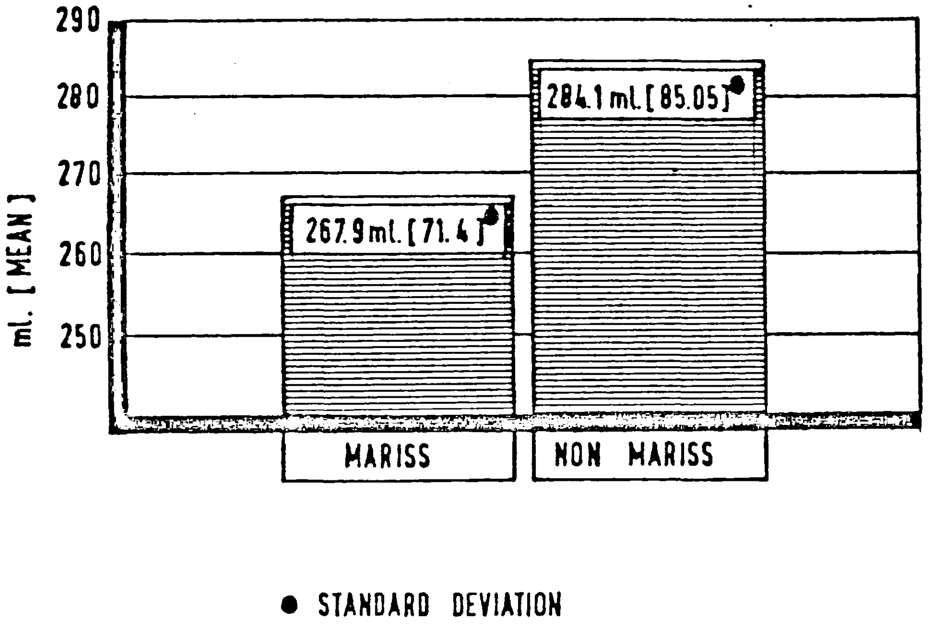

FIGURE: 5.4 TOTAL FOOD INTAKE AT DAY 7 (ml. MEAN) FOR MARISS AND NON-MARISS BABIES (not significant at $p < .05$)

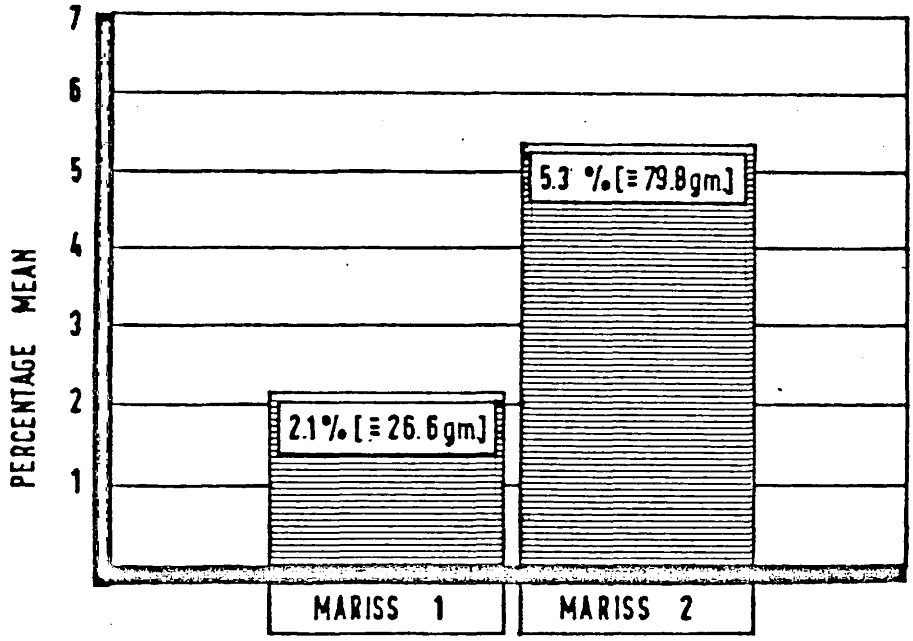

FIGURE: 5.5 FIRST WEEK WEIGHT LOSS FOR MARISS GROUP FOR :

(i) ≤ DAY 2

(ii) > DAY 2 ≤ DAY 5

A further point of contention is that babies who lost less weight during the first week, also have been those who had a greater feed intake (see Appendix VII). Fig. 5.3 shows the percentage mean of weight loss (in gm.) during the first week for both intervention and non-intervention groups, whilst Fig. 5.4 shows the total food intake at day-7 (mean in ml.) for both groups*. The total food intake at day-7 was less but not statistically significant for the experimental group. Fig. 5.6 shows that the total food intake day-7 was less for the VERY early stimulated groups (MARISS-1). Since the body weights of the two groups were not statistically different, it is likely that MARISS has a role in assisting low-birthweight infants to start to gain weight earlier. Although speculative at this stage, the mechanism of sucking may explain this outcome (at day-7), since the stimulated group also had a better performance in sucking at day-7.

Finally, of material assistance in gaining more widespread acceptance of the efficacy of stroking therapy is the favourable quotation of the work of Rice (Gottfried, 1981) that "intervention began only in the first month post-hospital discharge, and here too there were positive effects on weight gain, neurological and sensorimotor development". The development of MARISS from R.I.S.S., and the results of the two, suggest a key role with accurately defined scope in the future, for tactile stimulation derived from MARISS, and not dependent on any other form of stimulation. This is discussed further in Chapters 6 and 7; see also Appendix VI.

Accordingly the view sustained by the results published in this thesis, together with other published and accredited evidence, is that the technique of MARISS has been of material assistance to preterm babies needing to have their developmental potential enhanced, and to

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* At Hospital -1, the variable of food intake was not recorded.

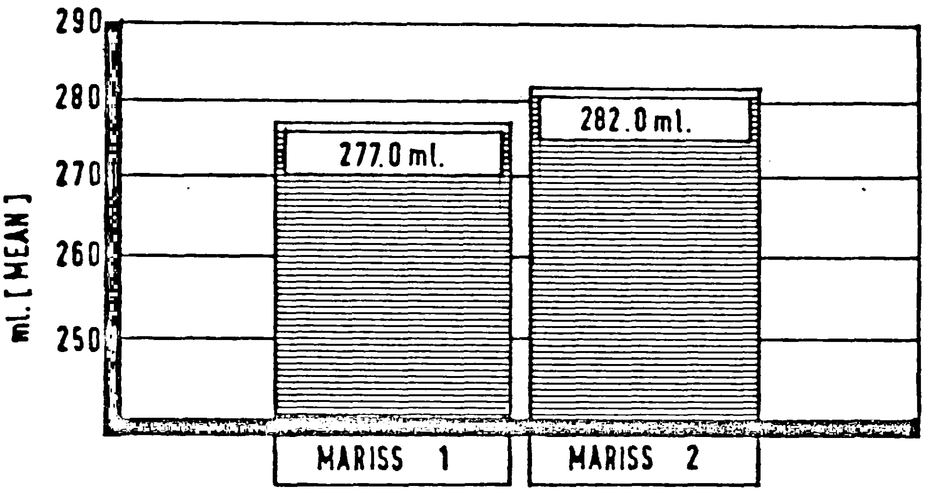

FIGURE: 5.6 FOOD INTAKE AT DAY 7 FOR MARISS GROUP BEGINNING AS IN FIGURE: 5.5

receive compensation for two main elements in their circumstances:-

(i) their sensory deprivation for the loss of the stimuli enjoyed in intrauterine life,

and (ii) their sensory deprivation due to the highly artificial and technological life support environment in which they are growing to term.

5.11 Reflexes at one-week

The primitive reflexes are considered by some authorities as "interesting in themselves". Their value lies in their indications. They are asymmetric under certain pathological conditions, absent in generally unresponsive infants, and have a low threshold in hyper-responsive infants (Dubowitz and Dubowitz, 1981, p.34).

5.11.1 General

At the end of one-week the infants' reflex performance (sucking, rooting, palmar grasp, crawling, and passive movements of arms and legs) had improved for both groups.

However, the intervention group performed significantly higher ($p < 0.05$) for all five reflexes. Their responses, as expected, were mainly hypoactive; testing was done before a stroking session.

Since there was no significant difference amongst the subjects as measured by these same reflexes at birth, the result suggests that the stimulated (stroked) group had derived benefit from the tactile (stroking) stimulation, as indicated by the performance for these 5 reflexes. This result shows, in short, that the stroke group were more responsive, although hypoactively (Table 5.10).

5.11.2 Rooting

Rooting response was evoked with the infant in a supine position, symmetrical with hands above chest NOT in States 1, 2.

Table 5.10 - t-values of Differences in Infants' Variables (Reflexes), measured at one week.

Group		Reflexes					
						Passive Movements	
		(1) Rooting	(2) Sucking	(3) Crawling	(4) Hand-grasp	(5) Arms	(6) Legs
Intervention (N-25)	Mean	0.7	1.5	1.1	0.6	1.2	1.6
	S.D.	0.6	0.7	0.5	0.6	0.7	0.5
Non-Intervention (N=29)	Mean	0.4	0.9	0.6	0.1	0.8	0.9
	S.D.	0.5	0.8	0.5	0.4	0.5	0.6

(1) Significant at $p < 0.05$
(2) Significant at $p < 0.002$
(3) Significant at $p < 0.002$
(4) Significant at $p < 0.003$
(5) Significant at $p < 0.025$
(6) Significant at $p < 0$

This reflex was found to be of limited value for the present study, and corresponds with the expert's view that it is "often present in abnormal infants, and absent in very apathetic and generally unresponsive infants" (Dubowitz and Dubowitz, 1981). These investigators also mention (pp. 35-36) that "contrary to expectation, it is also usually present in infants on continuous tube-feeding".

The results of the present study do not indicate this; moreover, the results do not yield evidence to confirm that rooting appears necessarily before sucking. In the view of the author as far as preterm babies with the same characteristics in this sample are concerned, rooting performance is not indicative of sucking performance.

5.11.3 Sucking

Sucking response was assessed by placing an index finger, with tactor pad toward the palate, in the mouth of the infant.* The infants' position was supine, but not in States 1, 2. The importance of sucking as a sign of the neurological well-being of the infant (Dubowitz and Dubowitz, 1981) is controversial; however the view cannot be underestimated that preterm babies badly need to be able to suck in order to be rid of tube feeding. Sucking has a crucial role in the feeding of preterm babies. To reproduce the argument recorded earlier in this thesis, it is known that sucking produces saliva, which contains a powerful lipase made in the lingua serous glands (Hamosh, 1983). The role of lingua lipase in fat digestion has been argued, but it is agreed that some preterm infants are deficient in fat digestion and that this latter may be stimulated by sucking. The digestion and absorption of fat has a crucial role to normal development. Fats provide fatty acids necessary for brain development (Hamosh, 1983).

The necessity for tube-feeding may have other implications such as the production of less saliva, hence insufficient supplies of the lipase and inadequate digestion of energy-giving fat. Privation of stimulation may delay the appearance of a sucking action deemed to be "good enough",

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* 'Intensity' of sucking was assessed according to Brazelton's scores.

and also may well slow down the performance of any given baby whose sucking at birth is very satisfactory (stronger within 3 days than at day-seven). Albeit speculative at the moment, it may be worthwhile to carefully look at the direct effects of stroking on the development of sucking reflex.

It may be adduced that babies who had been treated (by being stroked) were showing a certain degree of control in changing their state in receiving special stimulation around the mouth to increase their capacity for sucking; thereby they were probably changing the environment in showing that they could be offered a bottle or breast earlier than commonly thought possible in the Special Care Baby Units.

Recent study (Wozniak, Fenton and Milla, pre-print, 1983) on 'The Development of Fasting Small Intestinal Motility in the Human Neonate' concluded that the sucking reflex starts to develop from 33 weeks gestation during the migrating motor complex activity stage of the postnatal development of small intestinal motor activity. It is not yet known if the sucking reflex could somehow be stimulated in order to start its development earlier.

5.11.4 Crawling, Hand grasp and Passive movements (arms and legs).

Although yet hypoactive, responses at the end of week-1 showed that the intervention group were showing better hand grasp, crawling and passive movements. This suggested that the stimulation was encouraging the "normal" appearance of these reflexes, which generally appear after birth with normal full-term infants.

5.12 Parents' perception of the Intervention

Parents from Hospitals -2 and -3 were invited to answer a questionnaire, with the following questions:-

(i) How much do you think your baby enjoyed the stroking?

(ii) How do you feel when you are stroking your baby?

(iii) Does the stroking help your relationship with your baby?

64.1 percent of the mothers (N=13) and 2 fathers who were keen to stroke their babies, answered the questionnaire. The replies are of interest in indicating how best to approach the parents for the purposes of future work; a summary of replies are accordingly given below.

5.12.1 Question (i)

(a) "very much", "a great deal" or "quite a lot" (2 mothers and 2 fathers);

(b) "I do not know but "she might be having feelings" (one mother);

(c) "She likes it, since it calms her if she is agitated"; "awakens her in sleeping" (3 mothers);

(d) "She is becoming healthy and very happy" (one mother);

(e) "My baby enjoyed the stroking very much, as it was the only way in which she was really touched" (one mother);

(f) "It relaxes him" (one mother).

5.12.2 Question (ii)

(a) "Happy", "wonderful" or "getting pleasure" (4 mothers, one father);

(b) "In close contact, a good reason for physical contact" (one father, one mother);

(c) "Relaxed" or "good" (two mothers);

(d) "I come to know her "inch by inch" and that is the best thing" (one mother);

(e) "Nervous at first because she was very small" (one mother);

(f) "I feel like a nurse" (one mother);

(g) "A bit silly at first, but since she enjoyed it I treated it as a game-play" (one mother);

(h) "I comfort her in a very special way" (one mother);

(i) "Stroking helps her, so I am doing it" (one mother).

5.12.3 Question (iii)

(a) "Yes, makes me feel closer, especially because at first it is the only way to "hold" them" (4 mothers);

(b) "Helps both of us to be closer to each other" (one mother);

(c) "Helps her to get to know you" (one mother);

(d) "Helps to build a bond" (one father, one mother);

(e) "Close contact in a relaxed way" (one mother);

(f) "She feels lazy if I do not stroke her every morning" (one mother);

(g) "I give her extra time stroking her from head to toe. I am talking to her with her skin underneath. I see when she is not happy or when she is playful" (one mother);

(h) "Makes me feel like eating her with salt" (one father);

(i) "Helps her health, and it is a nice experience to a mother" (one mother);

(j) "I felt lonely, and it took me time to accept that I had a baby" (one mother).

(Note: one mother did not answer this question).

These answers clearly represent the importance of giving to the parents the right to closer contact by touching their babies soon after birth. Furthermore stroking is compensatory, in that babies are touched in order not to receive unpleasant stimuli, such as a blood sample. The results of this study thus suggest that babies also need to receive pleasant stimuli, e.g., stroking, and it may be adduced that this tends to develop bonding.

5.13 Differences in Infants' variables as measured at week-2.

5.13.1 Weight gain

"Weight gain is an important criterion of progress in the LBW baby, and there seems no reason not to aim for the best growth that can be obtained within the limits of gastrointestinal and metabolic tolerance" (Brooke, 1982).

"Growth signifies increase in size. Development signifies maturation of organs and system, acquisition of skills, ability to adapt more readily to stress, and ability to assume maximum responsibility and to achieve freedom in creative expression", (Silver, Kempe, Bruy, 1980).

The quotations above are well accepted by paediatricians. Growth and development are dynamic and continuous processes involving transactions of the individual with his/her environment. Weight gain is very tangible as an indicator of growth and development; its psychological implications in encouraging three-way transactions seem enormous. The first shock for parents of preterm babies is the size of their babies, who become even smaller during the first week. The tangibility of weight, published and written-up in grams, assumes a greater value in consequence since the mothers have to face initial traumas such as the feelings of failure and anticipatory grief.

5.13.2 Results

The stimulated group gained more weight (Table 5.11) than the non-stimulated group. This difference is not statistically significant for Hospital-1. This result, in accordance with related studies (Clay, Lipton, Ribble, all in Montagu, 1978; Rice, 1977, 1978), suggests that touching (stroking) helps to increase body weight. The difference between the stimulated

Table 5.11 - Differences in Infants' variables (weight gain) at week-2, expressed as weight at day-14 less weight at day-7 (t-values) by hospital and by group.

Groups	Hospital -1				Hospitals -2 and -3			
	Mean (gm.)	Standard Deviation	N	%	Mean (gm.)	Standard Deviation	N	%
Intervention	165.3*	49.0	6	10.2	155.9*	77.0	25	10.8
Non-Intervention	143.3*	55.3	6	8.9	151.4*	75.0	26	10.0
Intervention-1	-	-	-	-	169.0	82.0	14	11.2
Intervention-2	-	-	-	-	139.5**	71.3	11	10.3

*Not significant

**Not significant

and the non-stimulated groups is greater in favour of the stimulated (MARISS) group, although not significantly. It seems that the body-weight gap is less during the second week; this is confirmed by the data showing that the intervention group regained their birthweights earlier than the non-intervention group (Table 5.12) at all 3 hospitals.

Table 5.12 - Differences in Infants' variables ("caught birthweight day") by hospital and by groups

Group	Hospital -1		Hospital -2 and -3	
	Mean (day)	N	Mean	N
Intervention	10.5*	6	10.7	25
Non-Intervention	15.3	6	12.2	27

* Not significant

The psychological implications of the variable "caught birthweight day" is perhaps stronger than has been previously thought to be the case. The reaction of parents is quite different from those who work in SCBUs. With the latter, weight loss or gain is a routine measurement to be viewed against expected normal behaviour in weeks 1, 2 or 3. With parents, their first reaction is to look at the daily chart and daily notes** as an indicator of their baby's way of coping with

** At the hospitals where this study was carried out, the parents were free to study chart and notes.

prematurity and/or survival; in parents' eyes 1 gm gained is more important than 1 gm. lost, and much more positive.

5.13.3 Reflexes at two weeks

At 2 weeks the performance, for the 5 chosen reflexes of rooting, sucking, palmar graps, crawling, and passive movements (arms and legs), improved for both groups, but not at the same rate. Rooting showed a sex interaction in that the girls gave a better performance. The non-intervention group demonstrated better rooting than the intervention group ($p < 0.05$) as indicated in Table 5.13, whilst the intervention group showed better sucking. This difference was not significant ($p < 0.05$) in favour of the touched (stroking) group, yet neither showed a "normal" response (level 2). This result suggests that the intervention is positively affecting the appearance of primitive reflexeses, such as sucking, which is basic for feeding. The results of this study do not support the view that rooting is a precursor to sucking.

/Crawling, hand-grasp,

Table 5.13 - t-values of Differences in Infants' Variables (Reflexes), measured at two-weeks.

Groups		Reflexes					
						Passive Movements	
		(1) Rooting	(2) Sucking	(3) Crawling	(4) Hand-grasp	(5) Arms	(6) Legs
Intervention (N=24)	Mean	0.54	1.75	0.75	1.33	1.21	1.17
	S.D.	0.72	0.53	0.53	0.70	0.72	0.56
Non-Intervention (N=23)	Mean	0.96	1.22	0.70	1.09	1.09	1.09
	S.D.	0.71	0.79	0.63	0.41	0.51	0.51

(1) Significant at $p<0.05$

(2) Not significant at $p<0.09$

5.13.3 (Continued)

Crawling, hand-grasp, and passive movements (arms and legs) all indicated a better performance from the MARISS group, although the difference was not statistically significant.

Several criteria are employed to indicate that the infant is "coping", "doing well", "progressing" and that he/she may be "promoted"*, and hence "surviving". Two routine criteria are "starting to have a bottle", and "moving from incubator to cot". In the study described in this thesis, the intervention infants at Hospital-1 started to have bottles at week-1, and the non-intervention infants started at week-2 (Table 5.14); The difference is significant ($p < 0.05$) in favour of the intervention group, thus suggesting that this group did have better sucking potential since otherwise they would not have been offered a bottle. At Hospitals -2 and -3, there was no difference between the two groups.

The intervention group also moved earlier (Hospital-1) to cot than the non-intervention group, thereby suggesting that they could maintain their temperature in coping with the new environment better than the non-intervention group. At Hospitals -2 and -3, the difference is not significant; this variable had many missing values and hence the result should be treated with great caution.

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* At Hospital-3, "promotion" means:-

(i) changing from the intensive care BU to the SCBU, or to the "cool" room,

(ii) changing from incubator to cot,

(iii) starting a bottle, or breast feeding.

Table 5.14 - Differences in Infants' variables ("bottle initiation" and "move to cot") by hospital and group (t-values).

Group		Hospital -1*		Hospitals -2 and -3**	
		"Bottle initiation" (weeks)	"Move to cot" (day)	"Bottle initiation" (weeks)	"Move to cot" (day)
Intervention	Mean	1.0	7.0	1.9	12.6
	N	6	6	23	14
Non Intervention	Mean	2.0	20.0	1.8	11.5
	N	6	1	21	17

* results significant at $p < 0.05$

** results not significant

5.13.4 Behaviour during sessions of stimulation

Table 5.15 compared with Table 5.7 shows that the state of babies before a given session of stimulation does not differ from week-1 to week-2; nor does their state differ during, and immediately after stimulation. However, the state 5 minutes after is significantly different in the case of week-2, as might be expected. As the babies grow and receive stimulation they are able to sustain their state of readiness to the outside world, thus enhancing development.

5.14 Differences in Infants' variables at week-3.

5.14.1 Weight gain.

For the preterm babies, there is not doubt that weight gain is very much adduced by parents, doctors and nurses as and indicator of "thriving". To the question "How is she doing?", the most common answer is "Oh! She is doing all right; she is putting on weight all right, feeding well". This at least imples that the struggle of the "little people" born with tocwash is having a positive outcome. The environment is offering them in its role on helping them to override their disadvantage at birth, whereas early stimulation is showing not only a way to help directly the babies born "in-between", but is also counteracting the weird environment of the SCBUs.

Table 5.16 shows the results of weight gain during the third week. Missing values are due to earlier discharge or transference to another hospital. The stimulated group sustained its initial position of gaining weight more than the non-stimulated group. This result supports the hypothesis that touching (stroking, caressing, gentling, patting) helps body growth. Table 5.16 shows

Table 5.15 - Infants' Behaviour (Hospital -2 and -3) during the second weeks of stimulation (Mean and Standard Deviation)

	Variables	Experimental group (N=25)	
		Mean	Standard Deviation
1.	State before	1.4	0.6
2.	State during	3.9	0.6
3.	State immediately after	3.9	0.6
4.	State 5-minues after	3.2	0.7
5.	Peak of excitement	4.8	1.1
6.	Tremulousness	1.6	1.3
7.	Startles	1.6	0.5
8.	Lability of skin colour	2.4	0.6
9.	Motor maturity	4.1	0.4
10.	Hand to mouth facility	3.4	1.8
11.	Smile	0.1	0.2
12.	Stretching	1.0	0.3
13.	Purring	1.0	0.3

Table 5.16 - Differences in Infants' variables (weight gain) at week-3, expressed as weight at day-21 less weight at day-14 and as weight at day-21 less birthweight given in ( ) (t-values) by hospital and by group.

Group	Hospital-1				Hospitals -2 and -3			
	Mean (gm.)	Standard Deviation	N	%	Mean (gm.)	Standard Deviation	N	%
Intervention	211.7* (292.0)°	97.7 (99.0)	6	12.2 (17.8)	177.5** (269.0)°°	56.2 (115.0)	23	11.5 (18.1)
Non-Intervention	122.5 (140.0)	59.9 (85.0)	6	7.1 (8.0)	155.0 (189.0)	67.0 (142.0)	22	10.4 (12.8)
Intervention -1	-	-	-	-	179.4*** (277.5)°°°	46.0 (65.0)	12	11.6 (19.3)
Intervention -2	-	-	-	-	175.5 (257.3)	67.9 (160.0)	11	11.4 (17.4)

* Not significant ° $p < 0.02$

** Not significant °° $p < 0.04$

*** Not significant °°° Not significant

the mean weight gain over 3 weeks; the stimulated group shows better growth than the non-stimulated group. Table 5.17 shows that there is no significant difference amongst the full-term group (pilot study) in respect of weight gain at week-3.

Table 5.17 - Differences in Infants' variables (weight gain) at week-3, expressed as weight at day-21 less weight at day-14 (t-values) by group (pilot study).

Group		N	Weight gain	
			Mean (kg)	Standard Deviation
1.	PONCAT-1 (R.I.S.S.)	4	1.3	0.8
2.	PONCAR (Counselling)	3	1.2	0.3
3.	Placebo	2	1.3	0.9
4.	Control	2	missing values	

not significant

5.14.2 Reflexes at week-3.

At week-3, with the exception of rooting (greater but not statistically significant), the experimental group had a better performance than the control group in the chosen reflexes. Table 5.18 shows that at 21 days the performance lies between hypoactive and normal, with a trend to normal which is greater in favour of the stimulated group. This result is to be expected

Table 5.18 - t-values of Differences in Infants' Variables (Reflexes), measured at three-weeks.

Group		Reflexes					
						Passive Movements	
		(1) Rooting	(2) Sucking	(3) Crawling	(4) Hand-grasp	(5) Arms	(6) Legs
Intervention N=24	Mean	1.5	2.0	1.6	1.9	2.0	1.9
	S.D.	0.8	0.6	0.6	0.5	0.5	0.5
Non-Intervention N=21	Mean	1.1	1.6	1.2	1.6	1.5	1.5
	S.D.	0.6	0.5	0.4	0.5	0.5	0.5

(1) not significant
(2) significant at $p < 0.01$
(3) significant at $p < 0.03$
(4) significant at $p < 0.05$
(5) significant at $p < 0.001$
(6) significant at $p < 0.009$

since the stimulated group have been sustaining their improvement since birth, aided by the stimulation.

Although the control group at birth had a better performance, it appears that the lack of stimulation, plus the tube-feeding effect, has deprived them from exercising sucking. This point may have further implications to growth and development, according to Piaget's (op.cit.) idea of the importance of sucking for the development of intelligence.

5.14.3 Behaviour during stimulation

At the third (and final) controlled week of stimulation, the babies showed an increased control of their state (Table 5.19). Figure 5.7 shows the pattern of state for this intervention study. State is well-known nowadays as capable of changing the environment (Gregg, Haffner and Korner, 1976; Escalona, 1962; Brazelton, 1973; Prechtl, 1968; Stern and coworkers, 1969, in Parker and Rosenblatt, 1979). As Thoman has pointed out (op.cit., 1975), "state acts as a prelude, a mediator and an elicitor, as well as the context for any interaction that occurs between the infant and his mother"; in the view of the author, this also includes the infant's father, as a later picture has shown (Appendix VI) very well. The baby will demonstrate "gratitude" to the caregiver, who offers him/her withdrawal from a stimulus which is upsetting. Figure 5.7 repays further study; it shows the pattern of state for the intervention session during the three experimental weeks. The babies increased their performance, they were "alert, with a bright look; eyes open..." Of great interest is that if the caretaker is also "ready", the play session (one mother called it "the stroking") could continue, and the baby tended to feed better, as noticed by mothers and nurses (in Hospital -3 especially). As one mother (Hospital -2) said, "If I do not stroke her, she feels lazy and falls asleep and does not suck well". There is further evidence in Appendix VI.

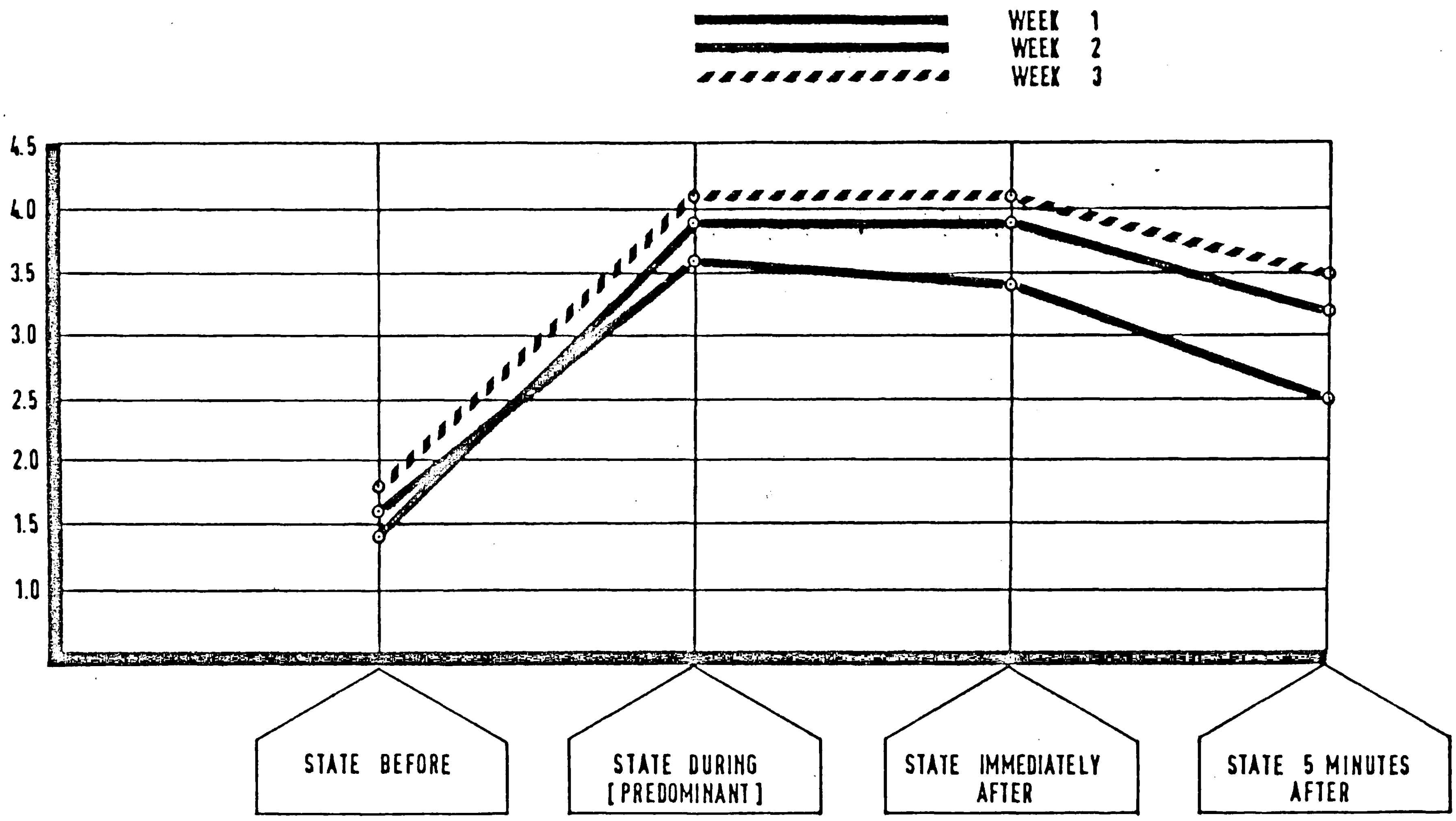

FIGURE: 5.7 MEAN FOR PATTERN OF STATE FOR MARISS GROUP FOR WEEKS 1, 2 & 3.

State is the "first control of the newborn", says Brazelton (1983). In particular, in controlling states of consciousness, the mechanisms so used can be seen as ego precursors, seeking and incorporating stimuli. By controlling input and output, and registering successes and failures, the infant prepares the base for self-awareness; all these factors are important for the establishment of the caregiver/infant transaction.

The capacity that infants have for experiencing pleasures and annoyances of sensation is known as "reality" (Lipsitt, 1983, 1979; Crook and Lipsitt, 1976a). Too little research has been carried out attendant on the study of pleasure reception and seeking. The stimulation used in this study, proved congenial for the babies, and showed itself to be pleasure-giving. The evidence lies in the responses of the babies themselves, either through the description of Brazelton's categories of behaviour or/and by the facial expressions shown by the pictures, films and slides, or by their "purring" and stretching, all of which is further augmented by the perception of parents.

Brazelton (1973), has pointed out that state depends on physiological variables such as hunger, nutrition, degree of hydration, and the influence of time within the wake/sleep cycle of the infant. In the view of the author, however, state may depend also on stimuli which are able to give pleasure, such as touching, caressing, and gentle but firm stroking.

The pattern of states, as well as the movements from one state to another, appears to be an important characteristic of infants in the neonatal period, and this kind of evaluation may be the best way of predicting the infant's receptivity and ability to respond to stimuli in a cognitive sense. The pattern shown in Figure 5.7 may also give some clue towards the development of "playing sessions" as some mothers suggested, and ways of adding visual, auditory and kinesthetic stimulation. The last techniques are very important, but the main interest of the study described in this thesis has been to look at the "pure" effects of stroking, since hitherto research on stimulation has been unable to separate the various effects of multimodal, early stimulation.

The view is now arising from such research, that touching (stroking) is the best elicitor for the babies to shift from one state to another. By prolonging the awake state, they will be ready for the outside world. By sucking better and being awake, obviously the feeding time will be shorter. It is well established that a common practice in the SCBUs is to hang the tube on the wall in order to feed a given baby, since the shortages of nursing staff (and the non-presence of the parents), implies that a particular nurse must sometimes spend half an hour feeding another "slow" baby who falls asleep very quickly. Dunn (1975) has found that early maternal vocalizations are related to rates of sucking, and both to later maternal vocalizations and maternal responsiveness; the importance of sucking is manifest. Moreover, in the view of the author the touching which elicits sucking and pleasure, will later become an elicitor of vocalization; "later" is used carefully because in this study "talking" was avoided during the experimental time because it is an additional stimulus and because of the main emphasis on touching (by stroking) at this stage. However, the mothers (n=6) who continued with the treatment, not so much systematically but at least once a day until discharge, showed this trend as can be confirmed by the film with the twins; touching not only elicited vocalization with the babies, but between the pair of parents when they were stroking their babies.

Five attempts (without the mothers observing) were made to observe the same behaviour with the control babies (using Brazelton's score), but it was impossible to establish this phenomenon without risking bias in the results.

Hines, et al., (1980) tested the hypothesis that infants born after 26 to 27 weeks GA would move less during the first three weeks post-partum than infants born after 28 to 30, or 31 to 32-weeks. The author inspired by Hines's study, tested the hypothesis that infants born after 29* to 30-weeks GA would show less "control" in changing state (state before, during, immediately after, 5-minutes after) during tactile stimulation sessions (MARISS) than infants born after 30 to 32, 33 to 34 and 35-weeks. A two-way analysis of variance by group GA, over a period of 3 successive weeks, with repeated measures was calculated. The results are shown in Table 5.19. There were neither significant differences between the four gestational groups nor across the three post-partum weeks, nor in state before the stimulation (MARISS) session, thus suggesting that state did not vary with gestational age. Next, state during MARISS also showed no significant difference between the four gestational groups or across the three post-partum weeks, suggesting that MARISS evokes change in state regardless gestational age. State immediately after MARISS session showed no significant difference between the four gestational groups but showed significant differences across the three post-partum weeks ($p < 0.009$), suggesting that regardless of gestational age the infants who received pleasant tactile stimulation increased their readiness to transact with the outside world across the three post-partum

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* In this particular phase of study, only one subject was born with 27-weeks GA and none were born with 26 or 28-weeks GA.

Table 5.19 - MARISS sessions: differences in Infants' behaviour over a period of 3 successive weeks, by group GA.

Variables	Groups by GA							
	GA 29⊢30,(n=3)		GA 31⊢32,(n=6)		GA 33⊢34,(n=6)		GA ≥ 35, (n=2)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
1. State before								
week-1	1.1	0.2	1.5	0.4	1.7	0.7	2.0	0.3
week-2	1.0	0.1	1.6	0.9	1.5	0.4	1.5	0.7
week-3	1.2	0.3	1.8	0.6	2.1	0.4	1.6	0.8
2. State during								
week-1	3.2	1.1	3.9	0.4	3.0	0.7	3.9	0.4
week-2	4.0	0.4	3.9	0.6	4.1	0.6	4.0	0.3
week-3	4.3	0.4	4.2	0.9	3.8	0.6	4.4	0.8
3. State immediately after								
week-1	3.1	0.8	3.4	0.5	2.9	0.9	3.7	0.6
week-2	4.1	0.5	4.7	0.6	3.9	0.5	4.0	0.6
week-3	4.4	0.2	4.3	0.4	3.7	0.8	4.6	1.2
4. State 5-minutes after								
week-1	2.1	0.6	2.5	0.7	2.0	0.7	3.3	0.1
week-2	3.4	0.4	3.1	1.0	3.4	0.8	3.5	0.2
week-3	3.2	0.2	3.4	0.9	3.6	0.8	4.2	0.6
5. Peak of excitement								
week-1	4.9	0.9	4.8	0.8	3.8	1.1	4.7	1.0
week-2	5.2	1.3	4.9	1.0	4.7	1.0	4.6	0.5
week-3	5.6	1.6	5.4	0.4	4.3	0.8	5.2	2.0
6. Hand-to-mouth facility								
week-1	2.9	1.8	2.2	0.7	1.7	0.6	3.5	1.0
week-2	2.6	2.4	3.2	1.0	3.5	2.0	4.8	0.0
week-3	2.4	0.3	3.0	2.2	3.0	1.4	4.9	0.1
7. Motor maturity								
week-1	4.0	0.5	3.6	0.6	3.2	0.9	3.5	0.3
week-2	4.2	0.2	4.1	0.4	4.0	0.5	4.2	0.1
week-3	4.0	0.3	4.4	0.6	4.5	0.3	4.5	0.7
8. Smile								
week-1	0.0	0.0	0.8	2.0	1.0	1.5	0.0	0.0
week-2	0.1	0.1	0.1	0.1	0.2	0.3	0.0	0.0
week-3	0.8	0.7	0.1	0.2	0.4	0.3	0.1	0.2
9. Tremulousness								
week-1	1.5	0.5	1.3	0.4	1.3	0.5	2.3	1.8
week-2	3.2	3.5	1.1	0.1	1.6	0.8	1.4	0.6
week-3	3.5	3.9	1.0	0.0	1.0	0.2	1.0	0.0
10. Startles								
week-1	1.4	0.3	1.9	1.0	1.0	0.3	2.5	0.2
week-2	1.7	0.7	1.7	0.7	1.7	0.7	1.5	0.1
week-3	2.5	1.1	1.6	0.5	1.8	0.7	1.6	0.8
11. Lability of skin colour								
week-1	2.4	0.3	2.5	0.9	2.1	0.3	1.8	1.8
week-2	2.7	1.1	2.5	0.6	2.2	0.4	2.0	2.0
week-3	3.7	1.5	2.6	0.6	2.3	0.5	2.7	2.7

Notes: 1, 2, 3 ... 11, inclusive: all not significant by group GA
1, 2, 8, 9 and 10: not significant over the period of 3 weeks.
3: significant over the period of 3 weeks at < 0.009.
4: significant over the period of 3 weeks at < 0.001.
5: significant over the period of 3 weeks at < 0.08.
6: significant over the period of 3 weeks at < 0.07.
7: Significant over the period of 3 weeks at < 0.00.

ability to bring his/her hands to mouth. This latter may well be viewed as a "competence" of the tiny babies, which is likely to elicit a response from the caretaker; in consequence, it may well "work" as an "initiator" for communication between infant and caretaker, and vice-versa. A successful 3 minutes of mother-infant interaction (Brazelton, 1983 p.47) showed how a mother augments her behaviour, according to her baby's search for her, and vice-versa; moreover, since the "competence" of a LBW infant is lower than a healthy full-term baby, any response (movement, gesture) is likely to be more noticeable and thus appreciated by the parents. The results of Table 5.19 suggest that MARISS is an "appropriate" and "attractive" stimulus which might be able to create a disruption and reorganization of the system, and directly offer the infant an opportunity for inculcating knowledge about himself/herself and the mother. This process of reorganization also afford the parent a mutual opportunity for learning about their infant and themselves within the regulatory system (Brazelton, 1983).

A two-way analysis of variance (group GA over 3 successive weeks) with repeated measures was then performed for motor maturity, the author testing the hypothesis suggested by the work of Dreyfus-Brisac (1968, 1970 in Hines, op.cit.), that the smallest infants would have jerkier movements than those of infants born after a longer gestation. The results (Table 5.19) failed to find differences between groups, but found significant differences over the period of three weeks, a result in accordance with the findings of Hines et al. (op.cit).

This result also suggest that MARISS offers pleasant tactile stimulation, and certainly does not accentuate jerky movements. Regardless of their GA, the smallest infants as well as those infants born after a longer gestation period, experienced a stimulation which appeared likely to offer the opportunity of exercising their motor activity without hindrance.

Table 5.19 also shows the results for Tremulousness, Startles and Lability of skin colour. A two-way ANOVA (groups X weeks) with repeated measures was again performed, and failed to find differences between groups or with time. Only Lability of skin colour showed difference with time ($p < 0.06$).

Despite differences in methodology, this study provides a number of findings which are in agreement with Hines (Hines, et al., 1980). The difference in experimental technique was marked however; the MARISS study observed the infants in their "incubators", or in their cots on the ward during stimulation treatment (MARISS), whilst Hines and his associates observed the infants "undisturbed in their isolettes". However, the present study did show that there were no consistent differences between infants born at various gestational ages, or differences in the behaviour selected for observation during the treatment sessions. It is considered here, that an important outcome is the finding that small, pre-term infants can be encouraged by a pleasant stimulus, in the circumstances of the experiment, to change their State by opening their eyes*, stretching, purring or yawning may be an important outcome variable, as Hines and his associates pointed out "in the bonding process between the parents and their very small premature infants".

5.15 Differences in Infants' variables at discharge

Weight and head circumference at discharge were the routine physical assessment, followed by clinical comments made by the attendant doctor. The two groups at discharge did not differ significantly so as far as weight and head circumference were concerned (see Table 5.20).

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* Appendix VI includes the response of a preterm infant of 31 weeks whilst his mother (Picture VI.1),), or his father (Pictures VI.1 VI.2/3) was stroking (TAC-TIC). This evidence of response is significant notwithstanding it not being part of the main (MARISS derived) study; TAC-TIC is the refinement of MARISS and the final outcome of the work described in this thesis.

Table 5.20 - Differences in Infant's variables (discharge weight, head circumference discharge and discharge day) by hospital and groups.

Group		Hospital -1			Hospitals -2,-3		
		1) Weight discharge (kg.)	2) Head Circumference discharge (cm.)	3) Day discharge	1) Weight discharge (kg.)	2) Head Circumference discharge (cm.)	3) Day discharge
Intervention	Mean	2.2	-	29.2	2.2	32.4	38.4
	N	6	--	6	22	18	22
Non-Intervention	Mean	2.3		33.2	2.2	32.1	40.4
	N	6	-	6	2.0	17	19

1, 2, 3 not significant.

5.16 Differences in Infants' variables as measured at 40-weeks life-age (LA).

A neurological assessment of the babies, devided into 4 main categories, was made. The system adopted was that established by Dubowitz and Dubowitz (op.cit.), and the terminology to follow corresponds to its use in the assessment charts of Appendices I, II, and III.

All infants of Hospital -2 and -3 were assessed at 40-weeks life-age, at home. A cross-sectional group of full-term babies from hospital -3 (N=10) were recruited and assessed in hospital within 3 days (mean=2 days), in order to make comparison with the pre-term performance at 40-weeks life-age.

5.16.1 Habituation

Habituation is the capacity of the neonate to decrease response to repeated disturbing stimuli; it is one of the most impressive mechanisms of the newborn (Brazelton, 1973).

Dubowitz and Dubowitz (op.cit.) had found that habituation to light can be assessed in infants from 27 to 28 weeks gestation but that in general, infants under 31 weeks often exhibit the tonic type of response.

Habituation to sound is a useful item; it helps to identify the unresponsive deaf infant, and the hyper-responsive irritable infant. These influential research workers consider a poor response on habituation to be more significant than a poor response to auditory orientation.

In the case taken, the babies responded with Startles, or movements* 2-5, or 6-10 stimuli, then shutdown.

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* For practical reasons the subjects at Hospital -1, outside London, were not visited at home.

No significant difference was found between the intervention and non-intervention groups. At 40-weeks, they showed good (column 3) habituation to light, and good (column 3) to moderate (column 4) habituation to sound.

By the second day of life, the full-term infants have also good habituation to light and to sound (column 3,4). The results of the early stimulated group however are not statistically significant from those of the full-term with 48-hours. It is worth noting also that when the stimulated group is split into two sub-groups, the results show that the very early stimulated sub-group (see Appendix III) was very little different from the full-term group at 48-hours. These sub-groups were:-

(i) those who were very-early stimulated, who started the programme within day-2,

(ii) the early stimulated, who started the programme within day 5.

This result suggests yet another contribution to the answer to the ever crucial question, when to start with stimulation? Pre-term infants who were very early stimulated at 40-weeks demonstrated habituation to light and sound as good as the full-term group with 48-hours. Despite being a high risk group for neurological adversity, they tend to overcome their problems to prematurity, and if they have an "encouraging, appropriate environment" (Palmer, 1982) they are likely to derive advantages from prematurity in some areas of development.

5.16.2 Movement and Tone

Four sub-categories were used:-

(i) Posture

No significant differences were found between the intervention (MARISS) and non-intervention (non-MARISS) groups. Hips abducted (column 3) was the predominant posture for both groups.

The difference between these two groups and the full-term infants at day-2 was statistically significant only with regard to the non-intervention group and the full-terms. However the full-term babies showed more flexed posture (see Appendix I). This result coincides with the findings of Dubowitz and Dubowitz (p.52 case-1, 1981), and the findings of Palmer, et al. (1982).

(ii) Tone in the Limbs

This assessment involves arm and leg traction and recoil, and the popliteal angle. The difference were not significant (column 3).

(a) Arm Recoil

The preterm infants (column 3, both groups) showed less elbow flexion than the full-term infants (column 4) on the second day of life. However, with infants who were very-early or early stimulated, the difference was not significant compared with the full-term cases.

This result coincides with Palmer et. al. (1982), whose findings showed that the full-term at day -1 had greater flexion than the preterm infants at 40-weeks.

(b) Arm Traction

This did not follow the same pattern as arm recoil. The early stimulated group showed more arm flexion in traction than the non-intervention group. Statistically, this difference was not significant at $p < 0.07$. The difference between the two stimulated groups was statistically significant at $p < 0.05$, which again demonstrates that the infants had derived advantaged from their environments. The full-term infants showed arm flexion in traction as good as the stimulated group, at day-2.

(c) Leg Recoil

The preterm infants who were early or very-early stimulated mainly showed full response (see column 3) on recoil compared with the poorer (see column 2) performances of the non-stimulated group. Comparing the full-term with those of two-days of age, the difference between the stimulated group is not statistically significant, but the non-stimulated group and the stimulated groups is significant at $p < 0.005$, as also is the difference between the non-stimulated group and the full-term at $p < 0.005$.

(d) Leg Traction

Leg traction followed a pattern similar to that for leg recoil for all groups, but the difference was significant at $p < 0.05$ (see Appendices I, II and III). The stimulated group and the full-term babies showed similar resistance to traction. This is in accordance again with the findings of Palmer, et al., (1982).

(e) Popliteal angles

This also showed a similar pattern to that of leg traction; the difference was significant at $p < 0.02$.

(iii) Trunk and neck tone

This assessment gives an indication of head control, whilst the posture reflects trunk and neck tone. Head control (posterior and anterior neck muscles), head lag (traction response), and ventral suspension were not significantly different between the two groups (column 3). Good head control may occur with completely extended arms in normal preterm infants attaining 40-weeks (Dubowitz and Dubowitz, 1981).

However, the stimulated group's performance, and especially that of the very early stimulated group, were as good as that of the full-term infants. The difference in head control is statistically significant at $p < 0.05$.

5.16.3 Neurobehavioural items

Six sub-categories were used:

(i) Auditory orientation

Both groups showed auditory orientation at 40-weeks (see columns 2,3), as good as the full-term group at day-2. The very early stimulated group showed better auditory orientation at $p < 0.02$ than the full-term ones; this coincides with the findings of Palmer, et. al., (1981).

(ii) Visual Orientation

This followed a similar pattern to that of auditory orientation (see columns 2,3).

(iii) Alertness

At 40 weeks the pre-term infants of either group were more alert than the full-term group at day-2 (columns 3,4). The very early stimulated group was slightly more alert than the other groups, including the full-term one. The difference between the very-early stimulated group and the full-term was statistically significant at $p<0.002$; the difference between the non-stimulated group and full-term is noted as $p<0.04$. This result coincides with those of Palmer, et al., (1981).

(iv) Irritability

At 40-weeks, the intervention group showed less irritability than the non-intervention group. This was statistically significant at $p<0.04$. The difference between the stimulated group and the full-term group was not significant.

(v) Consolability

At 40-weeks, the intervention group showed better capacity to be consoled than the non-intervention group. The difference was not significant.

(vi) Cry

At 40-weeks, no significant differences in crying during the examination was found between the two groups.

The results on neurobehavioural items suggest that the early intervention group at 40-weeks life-age are better with auditory and visual orientation (not significantly), are more alert (not significantly), are less irritable ($p<0.04$), are easier to console (not significantly), and cry less during the examination than the non-intervention group (not significant). This result matches the opinion of some mother who said, "the stroking calms my baby if she is irritable and arouses her if she is asleep". It also shows that the early stimulated group have more "control" of their state changes; this is perhaps due to the fact that, during the stimulation session, they exercise control of their state by responding to the pleasure of being touched, and also by the effects of touching on the nervous system through the systematically-stroked skin.

As Dubowitz and Dubowitz (1981) point out, irritability, together with consolability and peak of excitement taken collectively, usually give a clear reflection of an infant who is unresponsive, apathetic, and difficult to arouse, on the one hand, or the infant who is over-responsive, hyperirritable and difficult to console, on the other. It is well known that unresponsiveness or over-responsiveness can reflect an abnormal neurological state. This result of the work described in this thesis is showing that the early tactile (stroking) stimulated group are less irritable ($p < 0.04$) than the non-stimulated group. The differences between the two groups on consolability and peak of excitement are not statistically significant.

In short, comparison of the preterm infants with the full-term newborn infants showed that at 40-weeks life-age (LA), the stimulated group has better posture ($p < 0.03$), less startles ($p < 0.03$), better auditory orientation ($p < 0.04$) and they are more alert ($p < 0.001$). The non-stimulated group as compared with the full-term group, also has less startles ($p < 0.01$) and are more alert ($p < 0.04$). However the "catch up" phenomenon is not present for posture ($p < 0.004$), arm recoil ($p < 0.008$), arm traction ($p < 0.009$), leg traction ($p < 0.03$) and head raising in prone ($p < 0.000$), thus suggesting that they would need a more "appropriate" environment to help them on these areas of development (see Appendices Ia, IIa and IIIa).

5.17 Differences in Infants' variables as measured at 3-months (mean).

Bayley Scales of Mental and Motor Development (MDI and PDI), were applied "blind" for Hospital-1 by a trained psychologist at the hospital. The assessment for Hospital -2 and -3 was not blind, and was carried out at home by the investigator; in consequence, these results and comparisons need to be considered cautiously for reasons of bias as well as for reasons of the differing environments for the assessment (Hospital and Home).

Figure 5.8 shows the results for all groups.

Full-term healthy babies are not significantly different from pre-term stimulated (MARISS) infants in respect of MDI and PDI at 3-months (mean AA). Full-term stimulated infants had greater MDI and PDI at 3-months than both of the preterm groups (MARISS and non-MARISS); this suggests that the full-term groups are also deriving benefit from tactile stimulation, thereby widening the performance gap between the full-term group and the pre-term, non-stimulated group.

The difference in MDI between the R.I.S.S. (full-term), and MARISS (pre-term - Hospital -1, Hospitals -2 and -3 groups) was not statistically significant, yet greater in respect of the full-term babies. The difference between the R.I.S.S. group and the non-MARISS (Hospital -1) group was not statistically significant.

The difference in PDI between the full-term babies and MARISS (Hospital -1) was not significant, but the latter did have higher PDI, as also did the non-MARISS (Hospital -1) group. The R.I.S.S. (full-term) group had greater PDI than the MARISS and non-MARISS groups, although the differences were not significant.

Table 5.21 shows the results for Hospital -1, and Hospitals -2, -3, separately; the MARISS group is split into MARISS-1 and MARISS-2. Again the MARISS-1 group has greater MDI and PDI than the MARISS-2 group; the difference in MDI is significant at $p<0.05$, but that for PDI is not significant. Within the terms of the study described in this thesis, this result suggests that there is likely to be a

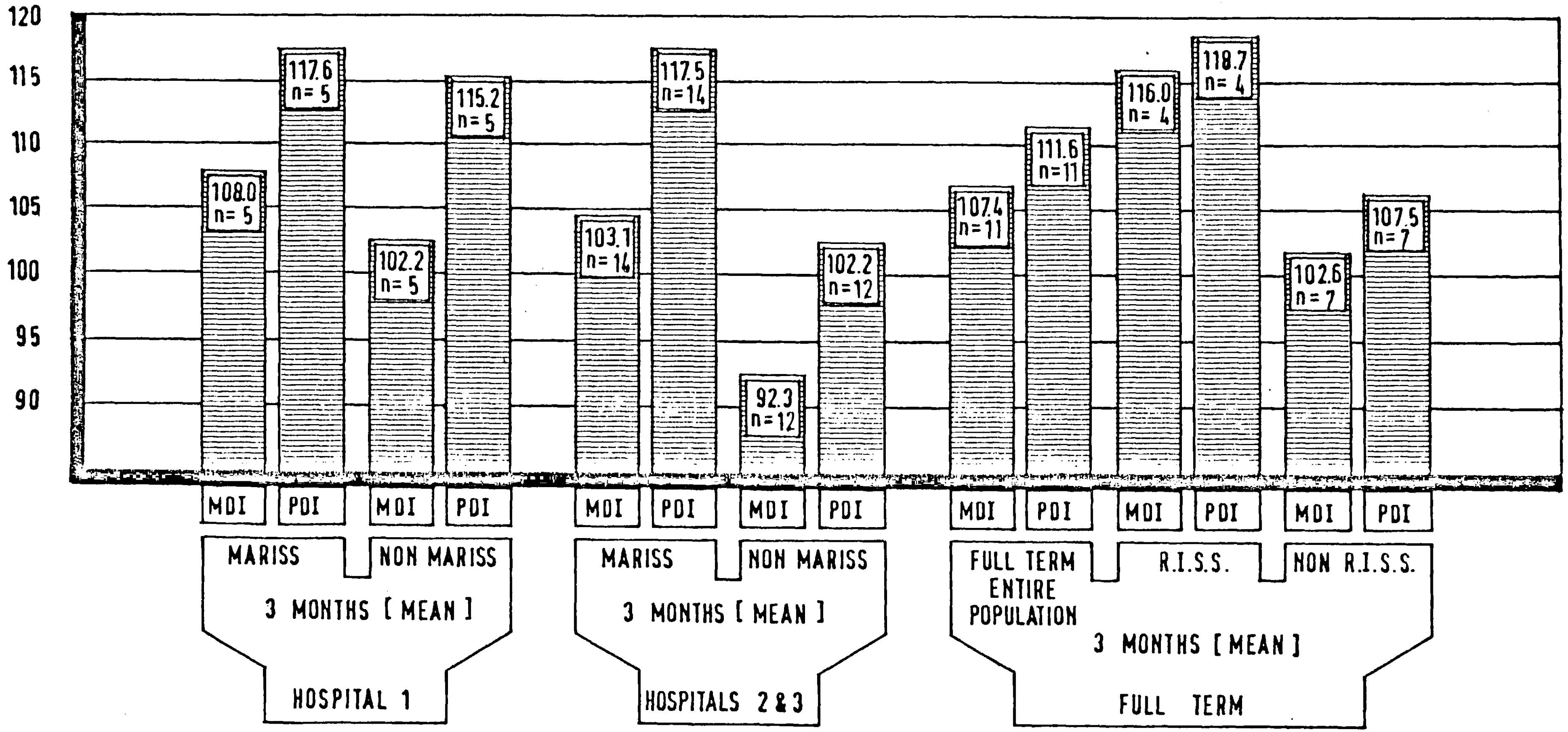

FIGURE : 5.8 BAYLEY INFANT DEVELOPMENT SCALES , MEAN SCORES (MDI & PDI) ACCORDING TO GROUPS AND HOSPITALS IN RELATION TO ADJUSTED AGE AT 3 MONTHS (MEAN).

Table 5.21 - Differences in Infants' variables (MDI and PDI) for Adjusted Age (AA) by hospital and by group measured at 3 months.

Group		Hospital -1		Hospitals -2 and -3	
		MDI (AA)	PDI (AA)	MDI (AA)	PDI (AA)
Intervention	Mean	108.0	117.6	103.1	117.5
	S.D.	16.0	19.6	18.6	29.0
	N	5	5	14	14
Non-Intervention	Mean	102.0	115.2	92.3	102.2
	S.D.	5.8	7.0	19.6	26.2
	N	5	5	12	12
MARISS-1	Mean	-	-	115.7*	121.6
	S.D.			9.2	24.2
	N			7	7
MARISS-2	Mean			90.6	113.4
	S.D.			17.1	34.7
	N			7	7

* Significant at $p < 0.05$

"critical" period for starting intervention with preterm babies.

Table 5.22 gives the outcome for the pilot study (full-term) according to group membership. The raw data shows that the R.I.S.S. groups (PONCAT-1) has higher MDI and PDI than the other groups. It is not possible to conclude anything due to the small size sample. The results suggest that full-term babies also benefit from early tactile, kinesthetic, visual and auditory stimulation.

5.18 Difference in Infants' variables as measured at 12 months (mean)

Bayley Scales of Mental and Motor Development (MDI and PDI) were applied "blind" by a trained psychologist. 20 infants from Hospital-3 (10 stimulated and 10 non-stimulated) were called back to hospital for assessment. For this study, a group of full-term infants, not seen at birth but allegedly healthy full-term babies, and arbitrarily chosen from the Birth Registration book by the research nurse (cross-sectional group 2), were called to hospital for development assessment. From 10 subjects selected, 6 were available (see Fig. 5.9).

Table 5.23 shows the results for the following groups and sub-groups:

(i) Intervention
(ii) Intervention, SGA
(iii) Intervention, AGA
(iv) Intervention-1 (MARISS-1)
(v) Intervention-2 (MARISS-2)
(vi) Non-intervention
(vii) Full-term

The full-term infants have greater MDI than the infants of the other groups. The differences (MDI) between the intervention group AGA and the non-intervention group is significant ($p < 0.03$) in favour of the stimulated group, thus suggesting that MARISS may have a long-term effect. The differences (MDI) between the non-intervention group and the full-term infants is significant ($p < 0.007$) in favour of the latter. The differences (MDI) between the intervention AGA group and the full-term infants is not significant, thus suggesting that the beneficial effects of very early tactile stimulation solely may be long term ones on mental development.

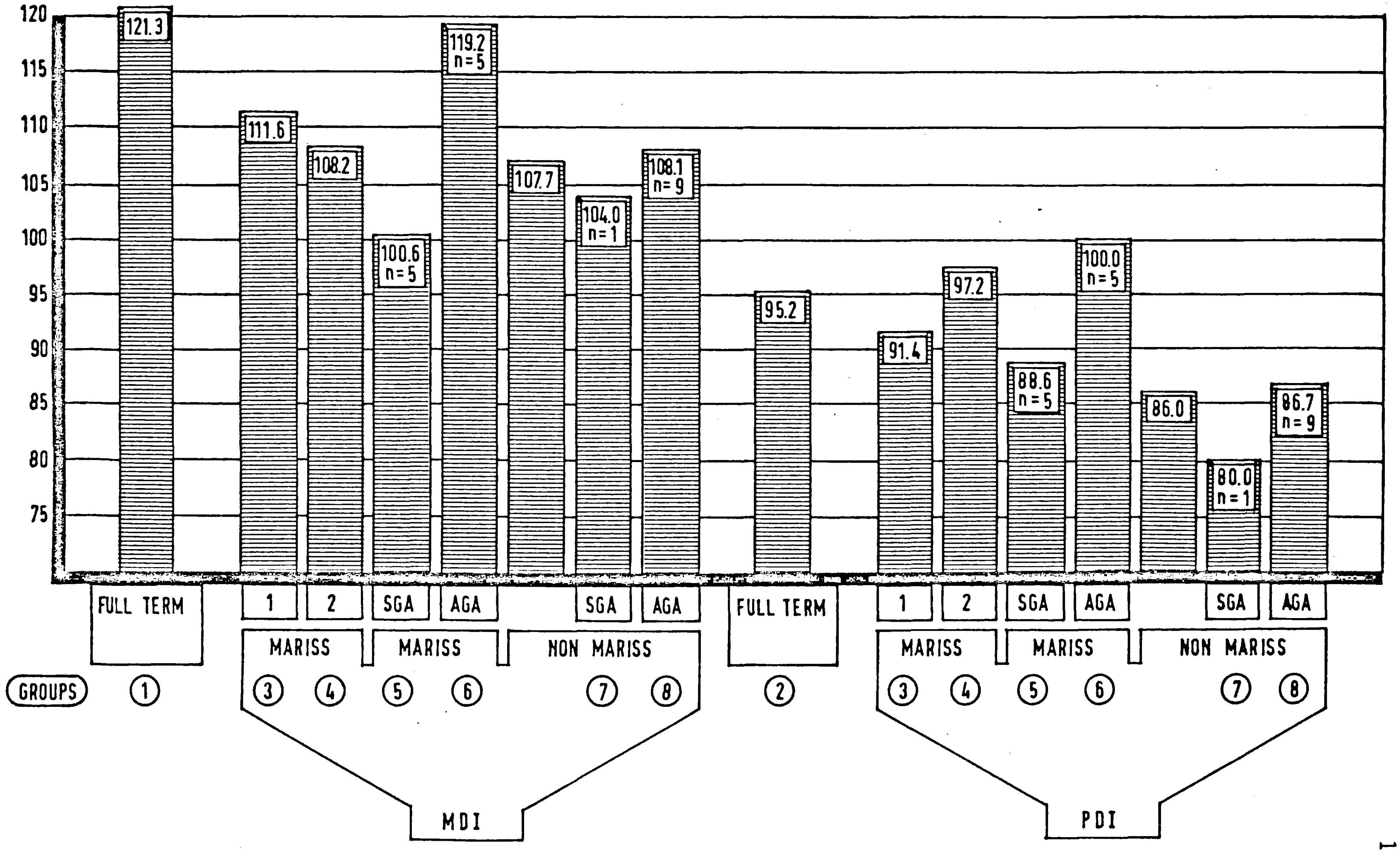

FIGURE: 5.9 BAYLEY INFANT DEVELOPMENT SCALES, MEAN SCORES (MDI & PDI) ACCORDING TO GROUPS AND IN RELATION TO ADJUSTED AGE AT 12 MONTHS (MEAN).

Table 5.22 - Differences in Infants' variables (MDI and PDI) for Adjusted Age (AA) by hospital and by group, measured at 3 months (pilot study-full-term babies).

Group		MDI	PDI
PONCAT-1	Mean	116.0 *	118.7
	S.D.	8.1	8.1
	N	4	4
PONCAR	Mean	104.0	109.0
	S.D.	19.1	7.5
	N	3	3
PLACEBO	Mean	105.0	109.0
	S.D.	2.8	1.4
	N	2	2
CONTROL	Mean	98.0 *	104.0
	S.D.	16.9	2.8
	N	2	2

* Significant at $p<0.05$

Table 5.23 - Differences in Infants' variables (MDI and PDI) for Adjusted Age (AA) by group, measured at 12 months (mean).

Group		MDI (AA)	PDI (AA)
Intervention	Mean	109.9	94.3
	S.D.	13.1	15.0
	N	10	10
Intervention (SGA)	Mean	100.6 [a d]	88.6
	S.D.	10.8	6.5
	N	5	5
Intervention (AGA)	Mean	119.2 [a b]	100.0
	S.D.	7.1	19.6
	N	5	5
Non-Intervention* (AGA)	Mean	108.1 [b c]	86.7
	S.D.	8.7	8.7
	N	9	9
Intervention-1	Mean	111.6	91.4
	S.D.	12.4	15.4
	N	5	5
Intervention-2	Mean	108.2	97.2
	S.D.	15.0	15.8
	N	5	5
FULL-TERM	Mean	121.3 [c d]	95.2
	S.D.	8.6	10.5
	N	6	6

* Only 1 subject SGA for the non-Intervention group. So, it is not possible to compare.

(a) $p < 0.01$
(b) $p < 0.03$
(c) $p < 0.007$
(d) $p < 0.006$

The SGA infants have lower MDI compared with the other groups whether stimulated, or not. The difference between the SGA intervention group and the intervention AGA group is significant ($p < 0.01$). The SGA infants' MDI is lower than the full-term group, thus suggesting that this group did not get as much benefits from the stimulation as the AGA group. This result supports the hypothesis that prematurity associated with the condition of "born too small", increases the risk of such infants remaining behind the healthy full-term babies in development; the effects may be long lasting.

There are no significant differences in PDI between the groups. including the full-term group.

The Bayley Scales of Infant Development have been widely used, without significant controversy. They have also been used with preterm infants (Seashore, 1981), who have consistently scored lower than full-term infants. The various studies have differed in the time and frequency of testing however, thus making comparison difficult between different research findings, a matter exacerbated by the several different forms of intervention. Notwithstanding these problems, a mention of significant results is appropriate here.

In Barnard (op.cit., 1981) a study is reported of the employment of a temporal pattern of movement (oscillating bed) and sound stimulation (heart-beat tone) for a 15-minute period. The Bayley Scales were administered at 8-months, the result clearly showing that the non-stimulated group had a poorer performance than the stimulated group. Such a result supports the hypothesis that early stimulation is beneficial for preterm infants generally; this theme appears throughout this thesis, and is mentioned further in Chapter 7.
Pederson (1981) states that LBW infants are obviously bombarded with auditory and visual stimulation in the SCBUs, but may lack stimulation by movement. What is surprising is that such authors in discussing, and in experimenting with, various kinds of stimulation do not mention the tactile (stroking) mode. This leads directly to the author's view that these lacunae in the literature may well indicate that the effect of tactile (stroking) stimulation on preterms has been neglected by the various authors involved. Further ....

(see next page)

consequences of these lacunae are discussed in section 5.20, below.

5.19 Correlations of Mental and Psychomotor Development Indices (MDI and PDI) measured at 12-months (mean) with all variables.

A summary of these correlations is given below in sub-sections 5.19.1 to 5.19.4, inclusive. The MDI and PDI, as measured at 12-months (mean) adjusted age are related to a wide range of variables.

5.19.1 At birth

MDI only correlated with birthlength and is significant at $p < 0.05$. This result tends to sustain the view that the condition of being "born too small" (SGA) associated with prematurity, increases the risk of later developmental difficulties.

PDI did not correlate with any variable at birth.

5.19.2 At week-1

MDI correlated with weight (loss), rooting, sucking, hand-grasp ($p < 0.03$), and with hand-to-mouth facility ($p < 0.002$).

5.19.3 At week-2

MDI correlated with weight (gain), state immediately after the stimulation session, lability of skin colour, hand-to-mouth facility ($p < 0.04$), and sucking ($p < 0.05$).

PDI correlated with lability of skin colour ($p < 0.003$), motor maturity, sucking ($p < 0.04$), crawling ($p < 0.02$), and hand grasp ($p < 0.02$).

5.19.4 At week-3

MDI correlated with weight (gain), and state immediately after the stimulation session but not statistically significant ($p < 0.06$).

PDI correlated with hand-to-mouth facility ($p < 0.006$), and crawling ($p < 0.04$).

5.20 Differences in Infants' variables (MDI and PDI) at 24-months (mean).

Mental and Motor Development Index (MDI and PDI) were blindly assessed by the same trained psychologist who did the 12-months assessment. The same 20 pre-term with 10 full-term babies were called; 17 pre-term and 6 full-term responded to the calling.

The results are presented in Table 5.24, and the differences are not statistically significant. The full-term group scores were consistently higher than any of the other groups and sub-groups of this study. The SGA groups consistently had lower scores even after receiving stimulation. The lack of SGA subjects in the non-intervention group which was called to the two-years follow-up study, made comparability of these two groups impossible.

5.21 Comparison of stimulation methods.

The literature regarding the effects of early stimulation on the growth and development of (very) low-birthweight infants does not distinguish between tactile stimulation and other stimulation methods. Furthermore, there are very few long-term follow-up studies in this area, in spite of their necessity being evident in assessing the final effects of the method(s) being studied.

Masi (1979) has presented a review of 19 studies dealing with supplemental stimulation. None of these included or were otherwise

Table 5.24 - Differences in Infants' variables (MDI and PDI) for Adjusted Age (AA) by group, measured at 24 months.

Group		MDI (AA)	PDI (AA)
Intervention	Mean	97.5	83.2
	S.D.	20.9	11.0
	N	10	10
Intervention (SGA)	Mean	95.0	86.5
	S.D.	22.2	11.2
	N	5	5
Intervention (AGA)	Mean	99.2	80.0
	S.D.	21.9	10.3
	N	5	5
Non-Intervention* (AGA)	Mean	98.4	82.7
	S.D.	12.7	16.0
	N	7	7
Intervention-1	Mean	100.6	83.1
	S.D.	20.3	12.6
	N	7	7
Intervention-2	Mean	90.3	83.5
	S.D.	24.7	4.9
	N	3	2**
Full-term	Mean	105.5[a]	74.6
	S.D.	11.2	7.5
	N	6	6

* Only one subject was SGA so it is not possible the comparison.

** One subject totally refused to be assessed (PDI.

a Not significant for any group.

concerned with a two-year follow-up to determine the longer-term effects of any method of tactile (stroking) stimulation. Nor was there a study of any group which received stimulation (stroking) commencing at the first day of birth compared with a group which started later, but within five days.

In order to narrow the comparison with the work described in this thesis, these studies which used Bayley Scales of Infant Assessment can be considered. There were three of these:-

(i) Solkoff, et al., (1969) obtained higher scores at 8 months for the stimulated group (rubbing of back, arms and neck).

(ii) Powell (1974) obtained better MDI scores at 4-months, and Bayley behavioural scores at 6-months for the stimulated group (handling by nurses).

(iii) Rice (1977) obtained better Bayley scores at 4-months for the stimulated group (massage treatment, and rocking administered by mothers).

The results of the three studies listed above support the view that (various) methods of stimulation promote better Bayley Scales scores. A recent study (Seashore, 1981) obtained no significant differences in Bayley Scale scores at 21-months between the pre-term, stimulated (handled) group and the non-stimulated control group; however the full-term infants of Seashore's experiment consistently scored higher.* An even more recent study (Barnard and Bee, 1983) demonstrated long-term (24 months) changes in the behaviour (higher MDI) of the preterm infants who experienced an intervention programme (temporally patterned kinesthetic and auditory (heart beat sound) stimulation) during their hospital confinement. Much yet is to be learned of this phenomenon. Further investigations seem imminent.

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* These accord with the results of this thesis, as shown in Tables 5.21 to 5.24, inclusive, and Figs. 5.8 and 5.9.

6.0 DISCUSSION.

The administration of tactile (stroking only) stimulation during the first 3 weeks of life of pre-term infants, with birthweight between Ø.76Ø kg. and 2.2ØØ kg., has been shown first of all not to be harmful. Treated infants moreover showed advantages particularly in physical growth (weight gain), neurological development (sucking, hand grasp, leg recoil and traction, popliteal angle, head raising in prone, arm release and body movement), neurobehavioural development (less irritability), and mental development (MDI).

Two obvious problems make any comparative and critical assessment of the intervention difficult; one arises directly from the methodology and the other is terminological. The purely methodological issue arises from the many varieties of stimulation and procedures which have been adopted by different research workers. The second issue is concerned with the meaning of stimulation. Various research workers have used different terminologies, such as 'stroking', 'finger-tip massage', 'rubbing', and even 'handling'. Precisely what is meant by these terms in any particular case requires interpretation in order to attempt any comparison of results.

The literature shows lack of consensus regarding the ecology of the preterm infant, and the dimensions and categories of stimulation; these features are compounded by the manifest difficulties of relating any laboratory (animal) research model to the early stimulation of the human infant. Since the 196Ø's, investigators have used a wide range of stimulation techniques and methodologies. Consequently, comparisons may well be inconclusive.

6.1 Nature of the Intervention.

Following Cornell and Gottfried (1976, 1981) there are at least three dimensions of intervention procedures:-

(i) the mode of sensory stimulation
(ii) the use of unimodal as distinct from combination modes of stimulation
(iii) the time and duration of stimulation.

6.1.1 Classification of studies in early stimulation

Such studies may be divided into two categories, with a possible third category. Into the first come those based on advocacy of simulation of the womb environment under the assumption that preterm infants should be compensated for environmental deprivation (Barnard & Bee, 1983; Barnard, 1981, 1973; Solkoff et al., 1969; Rosenfield et al., 1977; Freedman, Boverman & Freedman, 1966; Hasselmeyer, 1964; Korner et al., 1975, 1981; Neal, 1968; Matuszack, 1974; Solkoff & Matuszack, 1975; White and Labarba, 1976; Rausch 1981; and others identified previously in this thesis). The second category is based on the assumption that extra stimulation (as for full-term babies) should be provided for preterm infants in order to accelerate their development (Segall, 1972; Katz, 1971; Powell, 1974; Scarr-Salapatek & Williams, 1973; Williams and Scarr, 1971; Wright, 1971; and Leib, Benfield & Guidubaldi, 1980). The possible third category arises from advocacy both of simulation of the womb environment and of the full-term environment (Rice, 1977, 1979; Siqueland, 1973; Kraemer and Pierpont, 1976; Groom, 1973; McNichol, 1975). In the view of this author, this third is a significant category and, for the purposes of the work described here, three, not two, broad theoretical positions are taken as the basis for analysis and discussion.

6.1.2 Mode of stimulation and unimodal stimulation compared with multimodal stimulation

There has been much variation in the choice of any two particular, or more, modes of stimulation. Thus Kraemer and Pierpont, op. cit., White and Labarba, op. cit., Rausch, op. cit., Leib, Benfield & Guidabaldi, op. cit., used two modes of stimulation, whereas Rice (1977) used four. These authors moreover worked from two different theoretical positions, the first group from the first category and the last author from the third category, as given in sub-section 6.1.1. It appears highly likely that use of multimodal stimulation increases the probability of finding useful effects; it also renders more difficult the association of any particular effect with any one mode of stimulation in an assessment of results.

Another problem arises in control design. The nature of the intervention programmes themselves appear to create inhibitions in the use of elegant designs, as discussed later in sub-section 6.2.2.

This study has attempted to remove some important methodological problems, in particular by the identification and isolation of an independent variable; that is, unimodal stimulation which possibly could be beneficial for preterm infants. In general the literature of unimodal studies is sparse, but includes particularly Segall (1972), Katz (1971), Freedman, et al. (1966), and Scott & Richard, (1979). Even with a simple issue such as this, confusion arises; thus the Cornell and Gottfried (1976) classification would include the work of Hasselmeyer and Powell (both op. cit.), as unimodal, whereas in the author's system they are multimodal interventions. Cornell and Gottfried (op. cit.) and Masi (1979), classify rocking and tactile stimulation together as kinesthetic stimulation.

6.1.3 Terminology and classification of modes of stimulation

Clearly one mode of stimulation cannot be expected to have the same effect as another; moreover, the confusion introduced by the terminological problems, to which reference was made in the introduction to this chapter, needs first to be resolved.

For example, 'rocking' involving 'handling', or for that matter any other mode of stimulation involving 'handling' may not have the same effect as 'rocking' alone. The various authors do not always attribute the same meaning to particular terms; thus 'handling' has been used synonynously with 'stroking' by Solkoff, et al. (1969), where 'stroking' was really "rubbing the infants back until a burp had been produced" (p. 766). In the present author's view, 'stroking' 'rubbing' and 'handling' are three modes of stimulation which may well have different effects, and certainly need clear definition. In Powell (1974), for instance, 'handling' is not defined at all.

In animal studies there is no terminological confusion. Handling a preterm infant cannot be assumed to be the same as handling a rat. Denenberg (1964, p. 337) defined handling as "removing the pups from the home cage and placing the young into containers, where they are left for a short duration and then returned to the home cage". King (1958) has suggested that 'handling' is within his first category for environmental manipulations, which he defines as "stress, which includes a variety of 'traumatic stimuli'". Levine (1962a) proposes a classification of the experimental manipulations imposed on the organism during infancy based on two categories:-

(i) physical/mechanical,

and

(ii) non-mechanical/environmental, such as housing or feeding.

In Levine's system, if the technique involves imposing (on the animal) external stimulation, then such stimulation is classified as 'physical' and includes electric shock, loud sound, extreme temperature variations, mechanical rotation etc., as category (i); it includes 'handling' which in King's system (op. cit.), appears under the label of 'stress'. Certainly 'handling' does not mean 'stroking', and for that matter 'stroking' does not mean 'rubbing'.

Another simple classification for the stimulation of human infants, could be:

(1) natural,

(2) artificial.

These categories conform with Levine's system (op. cit.). However problems still appear when multimodal methods are being used; for example maternal variables would be included (by Levine) in the non-mechanical/environment category.

The present study has used 'natural' as distinct from 'artificial' stimulation. Stimulations which may be described as 'natural' include stroking, the sound of a mother's own heart beat, rubbing, a mother's own voice, rocking involving handling or the use of a rocking chair; 'artificial' ones include all variations of mechanical oscillation or rocking, a mother's tape-recorded voice etc. Swaddling, cradleboards, lambs-wool sheet, and mobiles, for example, are ambiguous but nevertheless incline towards the 'natural' category.

'Stroking', unimodally used and clearly defined, has not been used in any other investigations described in the literature. Even Rice (1977, 1979), who provided a major inspiration for the present study, used 'stroking' synonymously with 'finger-tip massage', and employed a multimodal and home-based-only programme. Comparison is all the more difficult when differences of intensity, frequency and length are concerned.

Finally, uniform 'handling pressures' were used by White and Labarba (op. cit.); they tried to achieve uniform pressures, but if more than one person was involved the 'same pressure' cannot be guaranteed. To avoid confusion introduced by the use of the word 'handling', this present study uses the expression 'touching pressure'.

6.1.4 Length of a session, frequency and duration of stimulation

The length of a session, frequency (number of sessions per day), and duration (number of days of stimulation) vary widely between studies. For example, the studies by Solkoff, et al. (1969) (employing 'rubbing' as synonymous with 'handling' and 'stroking'), White and Labarba (1976) (employing 'rubbing' and passive kinesthetic techniques), and Rausch (1981) (employing 'stroking', 'rubbing' and passive kinesthetic techniques) all differed in starting age, length of session and frequency; the duration however was similar. Solkoff, et al. began 12 hours after delivery (n=5), White and Labarba began within 48 hours following birth (n=6), and Rausch began between 24-28 hours after delivery (n=20).

The present study had a starting age within 5 days (120 hours), with a mean of 2 days (48 hours). Although there is a trend away from the 'critical period' concept, there may well be an 'optimum period' to start the intervention. The author produced some evidence that the gains were greatest if stimulation started before day-3.

Solkoff et al. used a 5-minute session each hour, 24 hours each day with an end point at day-10 (10 days); White and Labarba used a 15-minute session every hour for 4 consecutive hours per day with an end point at day-11 (10-11 days); Rausch used a 15-minute session each day for 10 days beginning with the day of starting the study. In summary, the integrated total of time at the end-point ranged from 150 minutes to 1,200 minutes. Of the three studies, that of Rausch covered the shortest period (150 minutes); she used three modes of stimulation, administered in three 5-minute phases. Essentially the intervention consisted of rubbing gently one part of the body first (starting with the neck), and stroking the same part afterwards. The second phase consisted of gentle flexion and extension of the limbs. These infants were treated in the mornings and in the awake-state. It was not reported if it was the same person who had given the treatment on all available occasions. Multiple treatment (three modes of stimulation) together with 'multiple touching pressure' may further confound the results. Solkoff et al. trained a nurse or aide to achieve similar pressure, whereas White and Labarba did not mention clearly if one or both experimenters offered the treatment.

In the present study the same length of session and frequency were used for all treated infants (hospitals -1, -2 and -3); the same duration was used for hospitals -2 and -3 (35 infants). As far as possible, the touching 'pressure' was the same for 41 treated infants using a unimodal stimulation (stroking only, with no handling); this facilitated interpretation of changes as a function of the intervention.

6.2 Samples.

6.2.1 Sample size

The range of sample size varies from 10 (Solkoff et al., 1969) to 128 (Barnard and Bee, 1983) preterm infants assigned to experimental or control groups. All but the studies by Barnard (op. cit.), Katz (1971) and the present study have less than 41 subjects for both experimental and control groups. These features, with the differences in sample selection and other differences already mentioned in this chapter, make exact comparison impossible.

6.2.2 Sample selection

Subjects were assigned randomly to experimental or control groups by Barnard (1981), Korner, (1981), Kraemer & Pierpont (1976), Powell (1974), White and Labarba (1975), Rice (1977, 1979), Freedman, et al., (1966), Solkoff et al. (1969), and Williams & Scarr (1971). They were systematically assigned by Leib, Benfield & Guidubaldi (1980), Scarr-Salapatek & Williams (1973), and by Hasselmeyer (1964). Katz (1971) assigned the subjects randomly first and then systematically by birth order. Rausch (1981) used matching assignment, and Segall (1972) used random and matching assignment. Investigators may well agree that the task of recruiting and selecting subjects from a high-risk population is frustrating, as Barnard has pointed out. This problem, together with the nature of the intervention itself, probably explains why it is so difficult to use a true experimental design (Campbell and Stanley, 1963).

In the present study (as mentioned in Chapter 3), the subjects were systematically assigned (Hospital-1), randomly assigned (Hospital-2), and matching and systematically assigned (Hospital-3).

The use of more than one method (multimodal) in making the sample assignment (random, matching and systematic) may be viewed as a drawback. The nature of the intervention itself together with the great difficulties during recruitment had to be taken into account, and 'adjustment to reality' had to be made. The studies which randomly assigned their subjects (Freedman, et al. 1966; Neal, 1968; Powell, 1974; Segall, 1972; Solkoff, et al. 1969; Williams and Scarr, 1971) did not refer to the problem of contamination of the groups if mothers met with each other, or if nurses were aware of the groups. The only way to avoid this problem is by having assignment made first to the control group infants and then for the experimental group. But how to reconcile this with the principle of randomization? An attempt was made, as explained in chapter 3, which could be called 'quasi-randomization'; that is, recruitment of the control infants was made first at random, whilst the equally random experimental group were discarded on grounds of likely contamination. The process continued with new babies until an adequate number of controls had been obtained. The random selection of experimental babies from the newly born then took place, discarding the controls, until a reasonable sample had been obtained.*

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* The disadvantage of this process was that it took 7 months to recruit 13 infants. This created a new problem: assessments at home for one hospital, overlapped with recruitment in the other hospitals. These hospitals and the clinic are all very very far from each other with much travel and loss of time in consequence (the clinic is out of London, as well as one of the hospitals).

On the other hand it can well be argued that the chance of the investigator biasing recruitment was remote. Moreover, the investigator did not look at the case notes before the end of the treatment, and was dealing with more than one hospital at one time.

6.2.3 Design

Early-stimulation studies with human infants have been inspired by infra-human studies (Denenberg, 1962, 1964; Levine, 1956, 1957, 1958, 1960, 1962) but direct application of procedures is impossible. A two-group design, with pretest-posttest control group (or only posttest) has been the most common choice in the studies mentioned here. The four-group design, despite its use for the pilot study, was shown to be unfeasible for both the main and the complementary study. Groom (1973) and McNichol (1975) have both used a two-factor design in an attempt to separate the effect of different modes of stimulation. Again, tactile-kinesthetic (rubbing and rocking) are interpreted as one mode of stimulation although, as already commented in section 6.1.2, the effects of 'rubbing' may be quite different from the effects of 'rocking'.

6.2.4 Measures of assessment

A further problem is concerned with assessment measures. In the studies mentioned above, all but Segall (1972) had included more than one outcome measure. The advantage of using multiple assessment measures is that the probability of detecting any effects of intervention is increased.

Weight gain was the most frequently used measure to assess physical development. Behavioral and neurological measures commonly used were the Neonatal Behavioral Assessment Scale (Brazelton 1973), or Dubowitz (1976), or the modified Graham behavior test for neonates (Rosenblith 1961), EEG, EKG, used in the neonatal period, the Cattell Infant Intelligence Scales (Cattell 1940), and Bayley

Scales of Infant Development (Bayley 1969) used with older infants. A less common measure was the infant's concurrent and immediately subsequent reaction to stimulation, which was employed in the present study,** but not recorded.

A blind study is certainly ideal so as to decrease possibility of bias. However a "blind" study in which the nurses or caregiving personnel do not know which subjects are experimental may well not be possible (Brazelton, 1981). Several studies reported 'blind' assessment (Katz, 1971; Matuszack, 1974; Neal, 1968; Scarr-Salapatek & Williams, 1973; Solkoff et al., 1969; Williams & Scarr, 1971; Kraemer & Pierpont, 1976; others either did not report it or were not 100 per-cent blind (Barnard, 1973, 1981; Barnard & Bee, 1983; Scott et al., 1983; Korner, 1981; Seashore, 1981; Hasselmeyer, 1964; Freedman et al., 1966; Segall, 1972; Wright, 1971; Powell, 1974; Leib, Benfield & Guidubaldi; White & Labarba, 1975). How blind is 'blind' has also been discussed by Beatty (1972) but his procedure was not used. None of the reported studies mentioned his criticisms.

In the present study the main experiment was not 100 percent blind. The complementary study was 100 per-cent blind. A research nurse collected the data for physical and reflex assessment, and a paediatrician applied Dubowitz (1981) Neurological Assessment of the preterm and full-term newborn infants. However, it may be argued that in the complementary study the technique was varied but the mode

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** The present study failed in recording this measure with the control subjects due to their unresponsiveness.

of stimulation was the same, namely stroking as in the main study, with the same timing and duration.

The difficulties of 'blind' studies in this field have been pointed out by Brazelton (1981, p.121), who says "a blind study in which the nurse or caregiving personnel do not know which subjects are experimental is certainly ideal, but may be well nigh impossible".

As with other studies (e.g. Segall, 1972; Katz, 1971; Hasselmeyer, 1964) this study did find differences between hospitals in outcome measures, but they were not significant; the trend was in favor of the treated infants' gain compared with the untreated infants (e.g. bottle fed and moved to cot earlier not significant for Hospitals-2 and -3; Bayley Development Assessment (MDI, PDI) at 3 months not significant for Hospital-1). However, this is a difficult comparison to make since studies using more than one hospital also had multiple treatments. Hasselmeyer (op. cit.) for example offered hair combing, stroking and cuddling and rocking; in this author's view, these are 4 types of stimulation. The approach of Segall and Katz (both op. cit.) was unimodal, offering only auditory stimulation. The effect on a certain outcome measure may be a function of a particular type and amount of stimulation, or even a combination of 'optimum' time of starting, type, amount and duration of stimulation.

6.3 Weight-gain.

6.3.1 Comparison of weight gain studies

In the case of weight gain, evidence varies between different studies. For example, Freedman, Boverman & Freedman (1966), Freeman (1969) Solkoff et al. (op. cit.), White and Labarba (op. cit.), Scott and Richard (1979), Scott et al. (1983), Rice, Neal and Scarr-Salapatek & Williams (all op. cit.), Barnard (1978), Kraemer & Pierpont (1976), all reported significantly greater weight gain for treated infants; Rausch reported greater but not significant weight gain. On the other hand Powell, McNichol, Solkoff & Matuszak, Hasselmeyer, Groom, Leib et al. (all op. cit.) and Korner et al. (1975) all reported no significant weight gain for treated infants. Due to this variability of results, the question remains to be studied of whether, or not, weight gain is a function of certain types of stimulation. At the moment, amongst the various studies of which the author is aware and already mentioned, only Solkoff et al. (rubbing), Scott & Richard* (lambswool), Scott et al. (lambswool), Neal (vestibular), Freedman (rocking), Boverman & Freedman (rocking), and the

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* It is worthwhile noting that there is a difference between this type of sensation (reafference) than, for example, the type of sensation in the present study (exafference). The former sensation results from the baby's own movement whilst the latter is due to outside agency.

present study (stroking) have used a unimodal stimulation and have assessed weight gain. The balance of published evidence is that, even tentatively, it cannot be concluded that weight gain is a function of tactile and/or vestibular stimulation. However, it is worthwhile to note that other multimodal studies which reported weight gain in favour of treated infants, included either tactile or vestibular stimulation within their combinations as follows:-

(1) tactile; kinesthetic, auditory and visual (Rice; Scarr-Salapatek & Williams)
(2) auditory and vestibular (Kraemer & Pierpont; and Barnard)

This, at least, yields evidence suggesting that weight gain is a function of 'womb-like' stimulations. Such results may strengthen the position of those research workers already quoted whose intervention-goal is to compensate for an experiential deficit, but with a view towards prevention of a developmental deficit if at all possible.

The present study showed progressive weight gain for treated infants significantly at day-21 (end of the treatment). A critical question ensues; by which neurophysiological mechanisms could the weight gain, as recorded in the stimulation studies with positive results, be explained? So far as this author is aware, such studies did not try to explain or suggest the processes or mechanisms involved.

6.3.2 Relevance of animal studies

It is useful to refer firstly to the animal studies, since the results of these also showed contradictory results regarding 'weight gain', but were subject to direct biochemical and biological investigations.

Levine, Alpert, and Lewis (1957) reported the same body weight for handled and non-handled rats. Denenberg (1961) reported superior body weight for rats handled for the first 10 days. Ruegamer, Bernstein and Benjamin (1954) reported that handled and individually petted rats had greater weight gain, which the authors suggested to be a result of possible differences in thyroid activity. Again, there are methodological differences between these studies which make them difficult to compare. In another study (Benjamin, in Mohtagu, 1978, p.187), caressed and cuddled rats learned and grew faster than coldly treated rats. The treated rats also had shown heavier brain-weight, and greater development of the cortex.

More cholesterol and the enzyme cholinesterase were found in brains of gentled rats than non-gentled ones, suggesting a more advanced stage of mental development, especially in the formation of fatty sheaths that surround nerve fibres, the myelin sheaths. It has also been suggested that the hypothalamus, which is known to play a role in the regulation of immunity, may also play a role here. Is it the same mechanism in human infants?

However interesting animal studies are in their own light, extrapolation to humans must be done with caution. As Taylor et al. (1982) have suggested, high reactivity in rats, for example, may not be comparable to neuroticism in people; extra stimulation in babies may not result necessarily in higher intelligence later in life; painful shocks which help animals to develop the capacity to cope with a wide range of stressful situations (Levine 1960) may not be comparable with capacity of people to cope with stress. It may be possible also that the developmental processes in both rats and humans after all may not be the same. If the results of animal studies cannot be generalized to our species they have the merit of contributing in several areas where experiments on humans cannot be done.

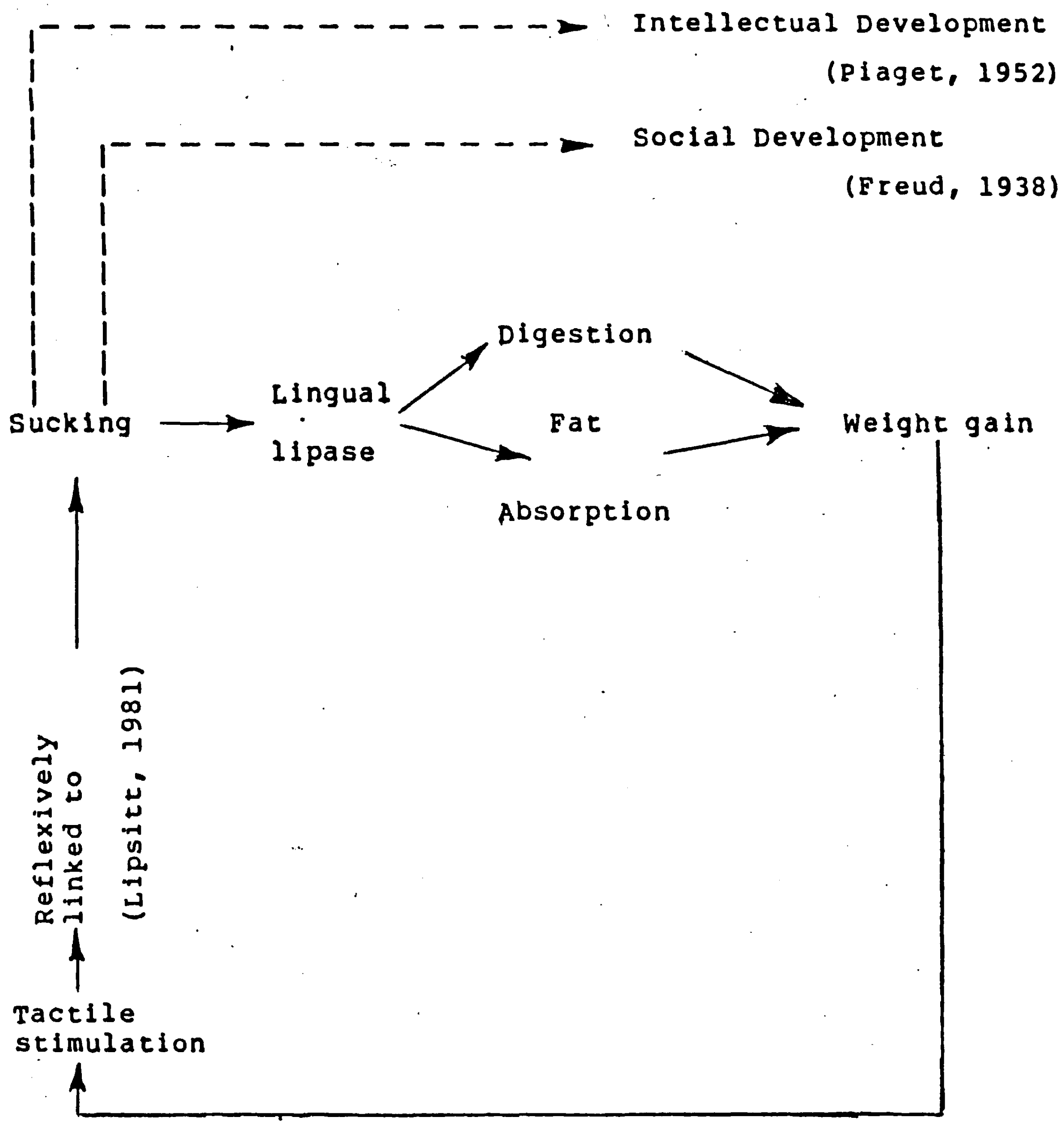
6.3.3 Hypothesis regarding weight gain of treated infants

Two speculative mechanisms may be proposed by which weight gain could be explained as a consequence of tactile (stroking only) stimulation. Both hypotheses, which may not be mutually exclusive, raise further questions;

(i) it may be possible that stroking is affecting the infants' metabolism indirectly through glandular action and hormones, or by cortical or sub-cortical loci acting through the hypothalamus and in the adenohypophesis? Is stroking accelerating the synthesis and liberation of important hormones which promote growth (somatotropic (SH), adrenocorticotropic (ACTH) and the thyrotropic and gonadotropic (TSH)? Would the babies maintain their rate of faster weight gain if they were stroked for a longer time? What are the implications of these phenomena for practice with preterms? These questions remain to be investigated.

(ii) The second hypothesis is related to better digestion and fat absorption by the treated infants (see Fig. 6.1). It is already known that fat accounts for approximately half of the

Fig. 6.1 Hypothesis regarding weight-gain loop.



dietary energy of preterm infants, and that such infants usually experience malabsorption of fat due to their physiological immaturity. Fig. 6.1 is an illustration of the factors involved in the greater gain in weight of treated infants taking into account that these infants in both studies (main and complementary) had better performance in sucking at days-7 and 21, and also registered less weight loss or slow weight gain (significant for hospitals-2 and -3), and faster weight gain (significant for 3 hospitals), respectively. A recent study (Hamosh, 1983) suggests that there is strong evidence that lingual lipase catalyzes the hydrolysis of dietary fat in the stomach. The function of lingual lipase in both digestion and fat absorption is of major importance in physiological and pathological conditions associated with pancreatic insufficiency, as occurs in prematurity. This lipase appears before 26 weeks gestation, and accumulates in the stomach before birth. Infants above 34 weeks gestation had significantly higher activity levels than infants of less gestation. Sucking may have a very important role on the secretion of lingual lipase. According to a recent study (Wozniak, Fenton and Milla, pre-print, 1983) the sucking reflex starts to develop from 33 weeks. The importance and the possibility of earlier development of sucking remains to be established.

If it can be demonstrated that simple tactile stimulation can be used to accelerate the onset of sucking action, then a significant means becomes available for premature baby development; the prime questions are whether, or not, there is a demonstrable reflex action between tactile stimulation and sucking action on the one hand and tactile stimulation and nutrient absorption on the other. These issues are continued in the next section.

6.3.4 Five primitive reflexes

The studies in the literature, already mentioned, did not focus on the performance of the primitive reflexes during treatment. In the present study rooting, sucking, hand grasp, crawling and passive movements (arms and legs) were (as mentioned in Chapters 3 and 5) assessed at birth (pretest), and at week-1, -2, and -3 (posttest). The infants were not significantly different at birth. Although not statistically significant the results showed a trend of progress in favour of treated infants for all 5 reflexes during the treatment phase of 3 weeks duration. However, sucking and hand grasp were statistically significant at week-1 (day-7) and at week-3 (day-21 and end of treatment) in favour of the treated infants. These data in the main study were not blindly assessed, hence there is need for cautious interpretation; however in the complementary study, which was 100 per cent blind, these results were confirmed (Appendices VI and VI.a).

So far as sucking is concerned the trend of the present results accords with Lipsitt (1981), who says "Tactile stimulation is reflexively linked to the newborn's sucking" and goes on to stress the importance of this for two major theories, namely 'Intellectual Development' (Piaget, 1952) and 'Social Development' (Freud, 1938). Although beyond the scope of the present study, it is worth noting the research interest that both nutritive and non-nutritive sucking have been occupying in the programmes dealing with infant development (Crook, 1976; Crook and Lipsitt, 1976; Lipsitt, et al., 1976). Sucking as a reflex of the newborn is of survival importance, and any simple means which encourages its development requires attention.

6.3.5 Concurrent and immediately subsequent responses of the baby to stimulation

The concurrent and immediately subsequent reaction of the baby to stimulation is little recorded in the literature (Gottfried, 1981). Its importance may have been underestimated. The meaning of a preterm baby's response is a recurrent problem (Lewis, 1967). On the one hand the use of response interpretations to argue the benefits of interventions may be tenuous (Cornell & Gottfried, 1976); on the other hand the observation and recording of how infants react, behaviourally and physiologically, to different types of stimulation is recommended (Gottfried, 1981).

Solkoff et al., and Rausch (both op. cit.) treated the infants when they were in the awake-state. White and Labarba (op cit.) did not report the state of the babies during treatment. There is agreement about the importance of state and its importance in the study of the newborn (Stratton, 1982; Brazelton, 1982; Hines et al., 1980), and to parent/infant relationship (Eyler, 1979; Olsen, 1981). The process of attachment is not a one-way process (Kennell & Klaus, 1983) and it is crucial to the survival and development of the baby. It was beyond the scope of this study to look at the pattern of transaction for treated and untreated infants. However, in this study the infants were treated initially in the sleep-state; changes took place during each session, and were recorded.

At the end of each treatment, there was always a pause of 5 minutes before the final state was noted; there were thus 4 recordings of state accompanying each session - at the beginning, during (predominant state), at the end of treatment and 5 minutes after completion of treatment. These results show a pattern of a short period of drowsiness or wakefulness when babies would be ready to react to the outside world, and clearly show that the state of the preterm infant can be modified by external influence. The babies' responses (stretching & purring), which were interpreted as meaning that they were enjoying the treatment, together with casual opinions expressed by whoever was around (often curious and sceptical) saying "they seem to enjoy it", lead one to speculate that this type of stimulation may have a role in parent/infant transaction. Hitherto there is no study in this area that included an outcome measure related to how the babies seemed to feel pleasure or not. This study used Brazelton's behaviour responses assessment (part) as well as the investigator's recording of 'stretching and purring' as a sign of pleasure. The importance of this however remains to be established.

The responses denoting 'pleasure' when the babies were receiving the stimulation was noticed also by parents, grandmothers, nurses and a few doctors. In future research, the baby's capacity for experiencing pleasure or annoyance may have to be taken into account. Stone, in

Lipsitt, (1983) declares that pleasure and pain alter subsequent adaptative behaviours. Lipsitt (1983) said that moreover many human activities enhance pleasure and reduce annoyance and promote learning through reinforcement.

Because none of the previous studies reported here recorded the responses of the babies during treatment, no comparison is possible. It may be that babies like one stimulation more than another one. These observations had to be recorded by the experimenter herself; a set of 8mm films show the babies' responses. Is it important that babies like the stimulation? It is, according to the following propositions:-

(1) emotional expressions are communicative and motivate the perceiver (Izard, 1971, 1977);

(2) "expressive movements provide sensory data to the brain for the cortical-integrative activity that produces emotional experience. Socially, facial expressions provide a set of signals that are important in fostering social relationships" (Izard, 1982, p.98);

(3) the capacity that infants have for experiencing pleasure and annoyance through sensation is sometimes called "reality" (Lipsitt, 1983, 1979; Crook & Lipsitt, 1976a); hence babies at risk are sensitive to pleasant as to unpleasant stimuli;

(4) unless we gain a greater insight into those aspects of development we call emotional the child's growth will not be fully understood (Kagan, 1978).

(5) state is not a confounding variable. It serves to set a dynamic pattern to allow for the infant's full behavioural repertoire

(Brazelton, 1982). "State is the first control system of the newborn" (Brazelton, 1983); the use of state to maintain control of the baby's own reactions to environmental and internal stimuli is an important mechanism and reflects his potential for organisation.

6.3.6 Neurological assessment as measured at 40 weeks

Despite not using the same measures, several studies reported that the status of infants receiving extra stimulation was better than that of control infants; these results appear when assessed by Brazelton and Rozenblith neonatal behavioral scales prior to leaving the hospital (Ktaz, 1971; Neal, 1968; Barnard, 1972; Matuszack, 1974; Solkoff & Matuszam, 1975; Scarr-Salapatek & Williams), especially in items involving motor development, muscle tones and auditory orientation. In our main study (using Dubowitz), treated infants (40 weeks life age) performed better on leg recoil, leg traction, popliteal angle, head raising in prone, arm release (all under 'movement and tone' category). It is worth noting that the infants treated before day-3, compared with those treated after day-3, scored higher for habituation to light, arm recoil, leg recoil and palmar grasp.

The responses of treated and untreated infants did not differ significantly for the various categories of the Dubowitz scale. Consistently however, the untreated infants did have the same or poorer response than the treated infants during the assessment (Dubowitz) sequence, as in the following items:-

(a) Habituation to light (same) and sound
(b) Posture
(c) Arm recoil
(d) Arm traction
(e) Head lag
(f) Ventral suspension
(g) Head control (Post neck muscle)
(h) Head control (Ant neck muscle
(i) Tremors
(j) Startles (same)
(k) Palmar grasp
(l) Rooting (same)
(m) Sucking
(n) Walking (same)
(o) Auditory and visual orientation
(p) Alertness
(q) Peak of excitement (same)
(r) Consolability
(s) Cry (same)

These results, excluding (b), (l), (n) and (o) (auditory only), and the trend of the non-blind main study were confirmed by the blind complementary study (Appendix VI).

The final, complementary study requires elucidation. The stimulation was unimodal (stroking without handling) in this case, and used the same technique as in the main study, but with slightly different movements; the changes in movements were derived from observations of infant response during the main study, and represented an optimization of the treatment.

Using this modified sequence of stroking and movements (n=20), 'blind' assessments showed that treated infants had less weight loss in the first week and higher weight gain at day-21; the treated infants scored significantly higher on sucking, hand grasp, posture, leg traction, body movement, rooting, walking, auditory orientation and less irritability. At six months follow-up, the treated infants scored higher on the Bayley Development Scale (MDI).

6.4 Pattern of the present work.

The sequential pattern of the present work can now be discussed. Starting with the proposition that a unimodal stimulation would enable identification of effects to be isolated, a scheme was devised which appeared reasonable following the work particularly of Rice (1975, 1977, 1978).

The main study was carried out with large samples, by comparison with those of most other research workers, and the results carefully assessed, but not wholly "blind". At the same time, items of the Brazelton Neonatal Scale of assessment (1973) were used to observe the concurrent and subsequent reactions of the babies. This conformed to the view of Gottfried (1981, p.58), "there is little objective and systematic information in the published intervention programs on infants' concurrent and immediately subsequent reaction to the stimulation. Intervention need not have a direct effect on outcome measures but may be the first link in the causal sequence." This in its turn led to the identification of an 'optimized' tactile stimulation sequence which was then used in a blindly assessed set of treatments, the results of which were positive.

Extending the scope of the present work further, the studies (from the literature) reported here (with the exception of Seashore) have failed to include full-term, healthy babies as a comparison group; the present study recruited two groups of full-term babies. One group was cross-sectional, and was used in 12 and 24 months follow-up Bayley Assessments, whilst the other was longitudinal and was followed-up from birth. Compared with this full-term untreated group, the preterm treated infants at 40 weeks life age had poorer posture but better auditory orientation, more alertness and fewer startles. The better auditory orientation is worth noting since Palmer et al., 1982, reported the same. This result is confirmed by the blind assessment in the complementary study with preterm infants before discharge and mean gestational age 36-37. The complementary study also confirmed the better performance for treated infants in leg traction and more normal body movement. It is interesting to note that these infants were assessed at a younger age than both the controls and the main study sample. They performed better in rooting, walking, and auditory orientation, and showed less irritability compared with untreated infants. These infants, it is worth noting, started treatment within 48 hours after delivery, and cast some light on the question of whether, or not, there is an 'optimum' time for starting the intervention.

6.5 Long-term Follow-up (Bayley).

Long-term follow-up studies, although desirable, are difficult. The literature on early infant stimulation (hospital based) contains only Leib, Benfield and

Guidubaldi (1980); Powell (1974); Barnard (1981) with Barnard & Bee (1983) who used Bayley Development Scales at 6; 2, 4, 6; 8 and 24 months, respectively. With the exception of Seashore (op. cit.), these studies did not recruit a full-term healthy group for purposes of comparison.

Seashore (assessment at discharge, 3, 9, 15 and 21 months) did not find differences between the two groups of prematures, but both groups scored consistently poorer than the full-term group in mental and motor development, for both life and adjusted age. The contact group used not well-defined criteria - 'handle and care as often as the mothers wished', thereby creating methodological problems.

Barnard (1981) and Barnard & Bee (1983) found differences of at least one standard deviation below their living age score between the life age and adjusted age scores for all preterm infants. These results represent conflict experienced by the parents who see the delay in responsiveness and development of skills. These results support the notion that an evaluation based on conceptual age will maximise performance; this may mislead interpretation and underestimate the seriousness of the delay. These authors' main interest was to check pattern movements and sound stimulation effectiveness, and their findings were that all experimental groups showed increased (8, 24 months) scores in MDI, whilst those of the control group dropped. The decline in Bayley assessment scores (MDI) with time, for the control groups, may be indicating strong evidence of the influence of experimental treatment on later development. Another possibility is that mothering, or fathering, or both, may also have changed as a result of the treatment itself, the treatment effects having made the babies more responsive and hence more rewarding to their parents.

The present study assessed the babies at 3 months (100 per-cent blind) at Hospital-1; no significant differences in MDI and PDI (adjusted age) were found, although the treated infants scored higher in both MDI and PDI. However this particular assessment of the present study used only adjusted age score, and the evaluation may have overestimated. Since the present study is predominantly concerned with early environmental influences on later development, the decision to use adjusted age was wrong according to Barnard (1981), and further analyses should take into account the infants' life age.

At 3 months blind assessment at Hospital-1, treated babies showed higher scores than untreated babies, but not significantly. At Hospitals -2 and -3, the results were significantly in favour of the treated groups but were not 'blind'; interpretation in consequence must be done cautiously.

At 12 months treated infants AGA had a higher score of MDI than untreated AGA infants, compared with a full-term (untreated) group; untreated AGA infants had poorer MDI score, but this position was not maintained at 24 months. Questions which arise are - did the preterms not 'catch-up' the full term group, or did the full term group for some reason have a poorer score at the age of 24 months than at the age of 12 months? The sample size of untreated SGA infants was not large enough to allow a strict comparison. Treated SGA infants had poorer MDI score compared with treated AGA and full term infants. This result supports the notion that SGA preterms are more vulnerable than AGA preterm infants; a further study is necessary with a greater number of SGA preterms in both groups. Also the question - Is more stroking beneficial to SGA preterms than to AGA preterms? - cannot be answered since there was only one SGA baby in the control group for the long-term follow-up study.

However, it is worth noting that SGA infants, even when stimulated, do not 'catch-up' their counterpart (AGA) treated infants and the full term (untreated) group. If the SGA should reach term, they would be even more at a disadvantage. Fancourth, et al. (1976) have shown that when the onset of growth failure had occurred before 26 weeks, there was a lower Developmental Quotient at 4 years, using the Griffiths Development Scale. SGA infants remain, as a group, more vulnerable.

At 24 months, treated AGA infants scored higher than untreated AGA infants, but again both groups did not 'catch up' the full-term group, as was the case in the 12 months assessment. It is also worth noting that all three groups scored poorer at 24 months (MDI and PDI) than at the 12 months assessment. Thus the three groups dropped their scores progressively over the second period of 12 months. It may be argued that:-

(1) the treatment did not have a long-term effect; this may be due to this latter effect being a function of length and/or frequency of stimulation, or even the age at which the programme was started;

(2) the mothers of the untreated infants may have been warned by psychologists about deficiencies on the one year score, thus creating an unwanted intervention;

(3) infants may not have been receiving appropriate stimulation from their environment;

(4) preterm infants' performance was maximized by taking into account prematurity.

The only other long-term follow-up study described in the literature is that of Scarr-Salapatek and Williams (1972, 1973). This was a multimodal study which used Cattell scores at 12 months. Again, the untreated infants showed poorer scores than the treated infants but direct comparisons with the results of other research workers are impossible.

6.6 Pattern of change in studies relating to Stimulation.

The results of both studies support the view that a child's early experience has some beneficial effect. The research has also raised a number of questions. Of these the immediate and most intriguing one concerns neurophysiological mechanisms by which one single and non-artificial type of stimulation acts to enhance growth and development of the preterm infant. The study clearly demonstrated that there were no harmful effects on babies born at risk in stroking them gently as early as within 24 hours after delivery. The routines of Special Care Baby Units were observed, and infection did not occur; apnoea attacks and bradycardias did not occur during treatment. No undesirable side effects were detected.

Stroking without handling was an essential feature of the method; it is necessary to amplify this point in that the babies were subject to the routines of 'minimal-handling' care within the SCBUs. With this reservation, the technique employed was unimodal. An additional beneficial side effect, of importance to studies in infant psychology and the concomitant need to develop a system of assessment, is that the infants seemed to enjoy being stroked.

In the main and complementary studies, observations of the responses of the infants were not blind*, but are recorded in the literature. However a set of films (8mm), pictures, and slides were made. They show that the infants during treatment showed enjoyment and calmness, or drowsiness, or alertness, and no signs of being disturbed, and no irritability. 'Extra touching' as distinct from 'extra handling' is not stressful, is not harmful, and does not cause cyanosis in babies at risk; all 49 experimental infants survived well.

It is not yet possible to say which particular mode of stimulation, or combination of modes, is the best. Individual differences and age seem to be crucial variables. Barnard & Bee (1983) have published the only long-term follow-up study, but still use two modes of stimulation despite the elegant experimental design and positive results.

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* The observations could not be blind owing to lack of funds for independent assessors.

Touching may also be one of the so called "predictable temporal patterning of experiences in utero", as suggested by Barnard & Bee (1983). "Rocking in utero" arises because of the confinement of the baby by the walls of the mother's uterus. Because the baby finds a lubricated barrier (mother's uterus wall), the body oscillates forwards, downwards and sideways. This suggests that kinesthetic, vestibular or propriovestibular stimulation is the more important for preterms, especially during the weeks before term. Barnard & Bee (1983) suggest that temporal patterning of experiences in utero is particularly important for preterms, and should be provided for them particularly during the first weeks of life, and go on to state that "temporal predictability in the final months of a term pregnancy is important for the central nervous system".

Stroking, as used in these experiments, is absent in utero, but there is irregular pressure from the lubricated wall of the uterus. Stroking nevertheless seems to be a very natural stimulation. Mothers furthermore may stroke their stomachs to alleviate the feeling of "pulling" during pregnancy, or as a caress to the baby. It is thus possible that natural rather than artificial stimulation may be preferable for preterms. When mothers move about, up and down, there is oscillation in the uterus, and it consequentially may be possible that a combination of 'natural' (stroking, natural rocking, and heart-rate sound) stimulation would give optimum benefit. Further studies should investigate these questions, but it is necessary for comparability that investigators should agree on a range of unimodal stimulations, careful definition of multimodal stimulations, follow-up studies, and uniform methodology.

Artificial stimulation it may be argued, increases the artificiality of the SCBUs environment. Parents participation, apart from providing transaction, may be more beneficial in offering stimulation (e.g. rocking, heart beat sound, stroking, etc) than mechanical apparatus. On the other hand, parents participation involves much more change of hospital routine, and adds more work for staff compared with the introduction of quite sophisticated apparatus. It is not insignificant that mothers and fathers, although sceptical at the beginning, may come to enjoy stroking as a form of play, rewarded by a blink, a purr, a smile, a yawn, or a stretching, all resulting from communication through the skin, hitherto so neglected, if not actually forbidden, for many babies born at risk.

At present Barnard & Bee (1983) and the present study are the only 24 months follow-up studies; it is consequently inappropriate to conclude in favour of any one form or mode of stimulation from a long-term point of view. Moreover the nature of the interventions on the dimensions emphasized by Cornell & Gottfried (1975), and Gottfried (1981), are different, as are their methodologies; Barnard & Bee (op. cit.) also lack a healthy full-term group for comparison, further hindering generalizability of results.

6.7 Replication of Tactile-stimulation-studies.

Fathers* and mothers should be contacted for permission and for participation in learning the technique, using first a doll. According to the babies' conditions, all or selected movements should be administered; it may well be that this requires more than one experimental group . After day-3 but before day-7, all parents should be able to administer the stimulation themselves. Response of the

* The research (film) shows how it is possible to get fathers to participate and enjoy stroking their babies.

babies should be video-taped for later analyses, or observed by one member of the research group, or by a nurse-student as part of her course-work (see Section 6.8, following).

However, appropriate support and approval by the relevant Ethical Committee is not enough for this type of research. In particular, the experimenter must not be seen by the parents as an 'outsider' pursuing a strange and unlikely course of action; parents are frightened of everything not 'prescribed' by the medical/nursing staff.

It is recommended that the same outcome measures of previous studies (Brazelton, Dubowitz, Bayley) should be repeated.

6.8 Practical Applications.

The first major condition for an 'optimum' environment for the development of an intervetion programme involving TAC-TIC is an attitude of acceptance by the staff of the SCBU. Once this is achieved, parents will feel confident to believe and participate in the programme, as part of car giving activities. Secondly, due to the constant changing in medical and nursing staff, periodical meetings with both groups and with parents, separately and together, should be held.

Parents need sensitive handling and they should be taught to use the technique appropriately (correct pressure and tender touching, and should not start on their babies until they have acquired the right skill with a doll). It is desirable that parents should understand that quality of survival depends on individualized care; this may appear obvious, but there is a danger that parents see the issue as one of an organised technique rather than one requiring subtle application. Not to be underestimated in this respect is the reaction of parents when first viewing the "artificiality" of SCBUs, and their shock at seeing their particular baby monitored and equipped for feeding, respiration, etc. The need thus arises for convinving parents that they can help to bring this phase of their infant's life to a successful conclusion and/or help subsequently by participating themselves in a "natural" form of intervention.

In the author's view, if the major conditions mentioned above are achieved, then the problems might well be minor ones. It is obviously necessary to have a well-trained person (i.e. nurse) (full-time) in charge of the programme itself, and obviously an independent assessor to check short-term and long-term changes in development.

After 2-3 weeks another type of stimulation, e.g., rocking chair, visual, auditory and talking, could be incorporated; the responses of the babies during stimulation must be recorded. For both phases (first 3 weeks, and thereafter until discharge), physiological data (heart rate, respiratory rate, temperature and oxygen rate) during stimulation, as well as behavioural responses must be recorded.

Undergraduate psychology, or medical students could also be motivated to participate as part of their training. Master's degree students, especially foreign ones, may sometimes need to participate in several tasks as part of their training; they should be encouraged to participate, but in a pre-organised way.

Finally unless a systematic treatment, with more uniform acceptance than hitherto, starts to appear, it will be very difficult to apply stimulation techniques readily in several Third World countries where, at present, progress is slow or non-existent. This would be a great pity in view of the high incidence of premature births, and infant mortality and the need to minimise investment by adopting techniques which depend only on an acquired skill, and not on apparatus availability.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 Position re original hypotheses

A primary objective of this investigation was to determine the residual effects of regular, organised, and early tactile stimulation on the development of the low-birthweight infant.

Conclusions can best be formulated by reviewing the original hypotheses. Each hypothesis is herewith restated, and followed by a brief summary of the relevant data.*

7.1.1 Hypotheses H(1) and H(2)

H(1) Early and systematic direct-sensorimotor stimulation may enhance neurobehavioural and psychological development of (very) low-birthweight preterm and full-term** healthy babies.

H(2) Preterm (very) low-birthweight babies, who are provided with early direct sensorimotor stimulation, may achieve the same level of neurobehavioural and psychological development as full-term babies.

These hypotheses were tested according to the following indicators:

(i) Weight loss or faster weight gain of the infants during the first week. In hospitals 2 and 3, the stimulated infants had faster weight gain than the non-stimulated group.

(ii) Weight gain during the third week.
At all hospitals the mean weight gain at the end of week 3 (compared with birthweight) for the intervention group was greater and significant.

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* Conclusions on the variables that were not blindly assessed should be interpreted cautiously.

** The full-term group (pilot study) was only assessed on their MDI and PDI at 3 months.

This result is congruent with the findings of Solkoff, et al., Neal, Barnard,Rice, all op. cit., and others, who also found that stimulated LBW infants made significant weight gains. These authors however (see Chapter 6), did not apply one single type of stimulation.

The mechanisms by which weight gain may occur as a result of the treatment have been suggested in Chapter 6.

(iii) Neurological reflexes such as rooting, sucking, hand grasp, crawling, passive movements (arms and legs) which normally appear "good" enough at birth, the performance of which tends to improve during the following 3 weeks in the case of full-term babies, were poor for both groups (postnatal intervention and non-intervention) at birth. Stimulated infants scored higher on two primitive reflexes (sucking and hand grasp) at days 7 and 21. The infants who had begun the treatment before or at day 2 postnatal age (compared with the treated ones who had begun the treatment after day 2 but within day 5) scored higher on the two reflexes of hand grasp and passive movements (legs), both at day 14.

(iv) Neurological and neurobehavioural examination done at 40 weeks life age (post-menstrual age); Dubowitz and Dubowitz's neonatal scale (see Appendices I, Ia, II, IIa, III and IIIa).

The stimulated infants scored higher on leg recoil, leg traction, popliteal angle, head raising in prone, and arm release; they also had more normal body movement and were less irritable. The results for leg traction and body movement are confirmed by the complementary study with blind assessment.*

Compared with a full-term (untreated group of the same age at hospital 3, the preterm treated infants had poorer posture, but better auditory orientation (congruent with the findings of Palmer, et al., 1982), more alertness, and fewer startles. Untreated infants scored lower than full-term on posture, arm recoil and traction, leg traction and head raising in prone. A possibility is that the stimulation had helped the occurrence of the 'catch up' phenomenon. It remains to the determined which of the stroking actions are more 'appropriate' for enhancing a

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* The complementary study showed better posture, rooting, walking, auditory orientation, more alertness and less irritability (p 0.05) for the stimulated group.

particular area of development of preterm infants. It appears that the mouth movements enhance better performance in sucking.

The results indicate that stroking alone enhances neurological maturity. Not yet understood is whether, or not, enhancement of neurological maturity leads to earlier and more effective enhancement of other functions of the body.

(v) Mental Development (MDI)

At 12 months AGA stimulated infants scored higher on the Bayley Development Scale (MDI) than non-stimulated AGA infants. Compared with a full-term (untreated) group of the same age at hospital 3, the non-stimulated AGA preterm infants had poorer MDI score. Stimulated SGA infants had poorer score (MDI) than both stimulated AGA and full-term (untreated) infants. It appears in the literature results of lower MDI for non-stimulated infants (Barnard; Leib, Benfield, and Guidabaldi; Solkoff, et al.; Rice; Powell; Seashore; Barnard and Bee, all op. cit. It remains to be learned which type of stimulation will increase the chances for occurrence of 'catch up' phenomenon, together with more detail about areas where the 'catch up' occurs. More investigations are needed with larger samples of full-term babies, preferably those in 'optimum' category.

7.1.2 Hypothesis H(3)

H(3) Early and systematic stimulation via parent counselling and instruction may enhance neurobehavioural and psychological development of very low BW and full-term babies.

This hypothesis could not be tested due to the small size of the sample.

7.1.3 Hypothesis H(4)

H(4) VLBW and full-term babies involved in early and systematic sensorimotor stimulation may change the attitude of their mothers towards them, thereby making the mothers and fathers more responsive to their babies' cues, and hence establishing better "social bonds" than those enjoyed by the control group.

This hypothesis was not statistically tested. The questionnaires in which the parents of low BW babies (intervention group) answered to their perception of MARISS, indicated that mothers and fathers were likely to be more "attuned" to their babies cues and thus a better chance of establishing a three-way transaction was likely to take place.*

7.1.4 Hypotheses H(5) and H(6)

H(5) Low BW babies who are provided with early and systematic indirect stimulation via parent counselling and instruction, may achieve the same level of neurobehavioural and psychological development as full-term babies.

H(6) The participation of the parents of very low BW and full-term babies in early and systematic indirect stimulation (counselling and instruction) may change the attitudes of babies towards their mothers, who are then likely to be given more cues, thereby establishing better social bonds than those existing within the control group.

These hypotheses were not tested.

7.2 Developments during the course of the research work

The responses of the babies to solely tactile stimulation very early after birth led to both interesting observations and new hypotheses. Earlier tactile stimulation, it was particularly suspected, could well minimise the many disadvantageous aspects of early separation. The separation of the infant from the mother, occurring in most of the high-risk nurseries with consequences to behavioural disturbances, is

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* Perhaps it is worth repeating the words of one mother, who said that in stroking her baby she came to know her "inch by inch".

challenging researchers at the present time. This area of work remains open to further investigation.

In any event the controversial features are two-fold. Firstly researchers have been using multiple stimulation techniques, the mutual interactions between which are indeterminable; from procedural and methodological points of view such approaches are regrettable, and can only hold up progress and add unnecessarily to disputation. Secondly, controversy is no substitute for programmes which aim to classify and identify the particular characteristics derived from the range of available stimulation techniques, notwithstanding the formidable scale of such investigations. Tactile stimulation appears to be efficacious alone, with the attendant advantage that it depends only on an interactive skill which potentially can be acquired by anyone. It cannot be claimed that the results are conclusive. Replication of the study would be worthwhile due to the implications they might have on infant behaviour and development, in pediatrics and in parent-infant transaction.

This study gives evidence that (very) early systematic, and gentle, touching of VLBW infants does not increase occurrence of infection. MARISS and TAC-TIC have both been shown to be benign, and none of the two techniques involves handling the baby.

This study suggests that "... mother's behaviour with her infant may be altered by what is done to mother, father, and baby in the period immediately after delivery" (Kennell and Klaus, 1983). Seventeen studies, at least, deal with deleterious effects of early separation (Klaus et al., 1972; Siegel et al., 1980; Sousa et al., 1974; Kennell et al., 1974; Ringler et al., 1975; Campbell and Taylor, 1979; Carlsson et al., 1978; DeChateau and Wiberg, 1977a, 1977b; Hales et al., 1977; Johnson, 1976; Kennell et al., 1975; Kontos, 1978; Sosa et al., 1976; Svedjda, Campos and Emde, 1980; and Thomson, Hartsock and Larson, 1979.

In summary, the results are not conclusive* regarding crucial questions such as:-

(i) 'Optimum' time of commencing intervention
(ii) Duration (i.e. amount) and continuity of intervention
(iii) 'Optimum' type of stimulation
(iv) 'Optimum' person to give the stimulation
(v) Direct or indirect effects of touching alone on the development of sucking reflex
(vi) Effects of touching alone on parent-infant transaction
(vii) Role of touching alone as an elicitor of emotional expressions
(viii) Role of touching alone on change of state

It may be noted that very considerable resources of human expertise and participation are necessary to fulfil a programme designed to establish results to the full extent of this list, (i) to (viii), inclusive.

7.3 Next research development

7.3.1 Human studies

The following 15 hypotheses are from physiological, psychological, sociological, educational and developmental categories; it is recommended that they should be included and tested in the next phases of neonatalogy studies. It is hypothesised that specific routines (movements) of TAC-TIC:-

(1) $H(F_1)$ will affect the infant's central nervous system (CNS)
(2) $H(F_2)$ will accelerate the synthesis and liberation of important hormones (SH, ACTH and TSH).
(3) $H(F_3)$ will be more beneficial for VLBW infants than kinesthetic or propriovestibular 'artificial' stimulation

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* This is due to (1) lack of funds for an elegant design and of increased scope, (2) life events beyond control of the investigator, and (3) the interaction of (1) and (2).

(4) $H(F_4)$ when combined with 'natural' heart beat sound and 'natural' oscillation movement, and lambswool sheet, will be more beneficial for VLBW infants than TAC-TIC solely.

(5) $H(F_5)$ will increase respiration rate, and hence diminish the need for (supplied) oxygen.

(6) $H(F_6)$ will increase both heart-rate and respiration, and hence diminish the risk of concurrent bradycardia.

(7) $H(F_7)$ will increase body temperature, and hence diminish the need for "artificial environments" (i.e., incubators).

(8) $H(F_8)$ will give pleasure and hence will increase the chances for establishment of infant/parent transaction.

(9) $H(F_9)$ will help development of sucking to start earlier that 33 weeks.

(10) $H(F_{10})$ VLBW babies who systematically are treated (stroked) in accordance with TAC-TIC will be likely to 'catch up' with the full-term babies in growth and development at ages of six months to one year.

(11) $H(F_{11})$ VLBW babies who are systematically stimulated (massage, physical exercise, playing, talking) from 6 months to two years, will catch up full-term healthy babies in growth and development at the age of 18 to 30 months (the experiments should incorporate clear differentiation between these various modes of stimulation in order to assess those which are most beneficial or can be rejected; this applies to $H(F_{12})$ and $H(F_{13})$ also.

(12) $H(F_{12})$ VLBW babies stimulated since birth will tend to neutralise their potential risk for child abuse.

(13) $H(F_{13})$ VLBW babies stroked from birth to 6 months, who continue to be stimulated systematically (playing, massage, physical exercies, talking), will have less school failure subsequently than non-stimulated LBW groups.

(14) $H(F_{14})$ VLBW preterm infants derive the capacity to show the emotions of pleasure/annoyance (AFFEX and MAX* codes) as soon as 27 weeks GA.

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* For optimum efficacy such "indicating and instrumentation" systems as AFFEX and MAX require substantial further consideration and experimental attention so that they can be expressed in ways which average parents can understand and utilise.

(15) $H(F_{15})$ VLBW preterm infants receiving very early tactile stimulation show greater vocalization aptitude (sentences with 2 or more words) than non-stimulated LBW infants.

7.4.2 Animal studies

1st stage

a) to produce an animal with immaturity (rat ?) through undernutrition of the mother;

b) to experiment with cutaneous stimulation (TAC-TIC), which endeavours to demonstrate that stimulated animals develop better than sibling controls.

2nd stage

c) to feed food (or supplements) with Carbon 14 in order to label milk protein, fats and lactose;

d) to compare incorporation of Carbon 14 in stimulated and non-stimulated immature animals (radio autography).

3rd stage

Depending on the results of the 2nd stage, to explore the possible mechanisms of better Carbon 14 incorporation for investigating:-

e) Synthesis and liberation of adenohypopheseal hormones (ACTH, SH, TSH);

f) Direct action on metabolism and/or membrane transport;

g) Direct action on nervous centres (by comparing size and number of cells in some nucleii).

4th stage (optional)

To conduct similar experiments on normal full term animals.

Rationale - Are the (expected) effects of tactile stimulation (TAC-TIC) specific for immature animals? Can they be demonstrated also on full term mature animals?

5th stage (optional)

Conduct similar experiments on 'normal' immature (not through undernutrition of the mother) animals.

Rationale - Do the (expected) effects of tactile stimulation (TAC-TIC) occur very early after birth specifically for undernourished immature animals? Can the effects be demonstrated <u>also</u> on nourished but immature animals?

6th stage (optional)

Conduct similar experiments on normal full-term, 'normal' immature, and undernourished immature animals <u>but</u> with two different people applying TAC-TIC.

<u>Rationale</u> - Are the (expected) effects of very early tactile stimulation on normal full-term, nourished but immature, and undernourished and immature animals the same when different people apply TAC-TIC?

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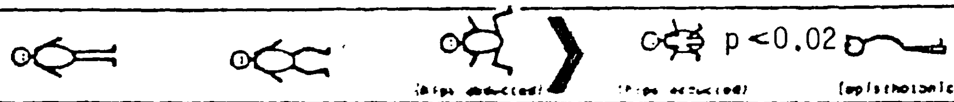
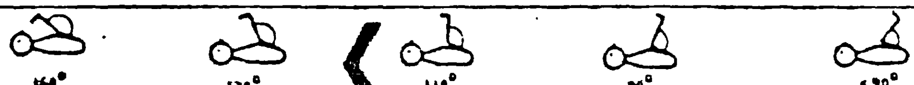
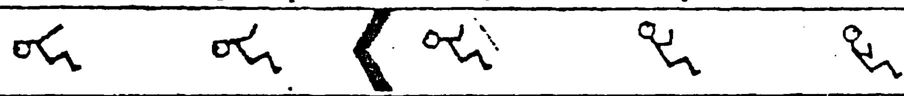
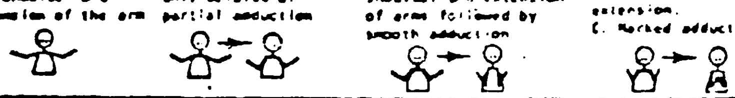
HOSP.	NO.	DATE OF EXAM	HEIGHT	GESTATIONAL ASSESSMENT	SCORE	WEEKS	3. [illegible]
RACE	SEX	AGE	HEAD CIRC.				4. Awake, eyes open, minimal movement. 5. Wide awake, vigorous movement. 6. Crying.

APPENDIX·I FULL TERM WITHIN 48 hrs. (HOSPITAL 3)

HABITUATION (< state 3)					
Light Repetitive flashlight stimuli (10) with 5 sec. gap. Shutdown = 2 consecutive negative responses	No response	A. Blink response to first stimulus B. Increasing response to repetitive stim. C. Variable response.	A. Shutdown of movement but blink persists 2-5 stimuli. B. Complete shutdown 2-5 stimuli.	A. Shutdown of movement but blink persists 6-10 stimuli. B. Complete shutdown 6-10 stimuli.	A. Equal response to 10 stimuli. B. Infant comes to fully alert state. C. Startles + major responses throughout.
Rattle Repetitive stimuli (10) with 5 sec. gap.	No response	Slight movement or blink to first stimulus	Startle or movement 2-5 stimuli, then shutdown	Startle or movement 6-10 stimuli, then shutdown	A. B. C. Grading as above
MOVEMENT & TONE	Uncover infant				
Posture (At rest - predominant) *			(hips abducted)	(hips adducted) p < 0.02	(opisthotonic)
Undress infant					
Arm Recoil Infant supine. Take both hands, extend parallel to the body; release quickly.	No flexion within 5 sec. R L	Partial flexion at elbow > 100° within 4-5 sec. R L	Arms flex at elbow to < 100° within 2-3 sec. R L	Sudden jerky flexion at elbow immediately after release to < 60° R L	Difficult to extend; arm snaps back forcefully
Arm Traction Infant supine; head midline; grasp wrist, slowly pull arm to vertical. Angle of arm scored and resistance noted at moment infant is initially lifted off and watched until shoulder off mattress. Do other arm.	Arm remains fully extended R L	Weak flexion maintained only momentarily R L	Arm flexed at elbow to 140° and maintained 5 sec. R L	Arm flexed at approx. 100° and maintained R L	Strong flexion of arm < 100° and maintained R L
Leg Recoil First flex hips for 5 sec., then extend both legs of infant by traction on ankles; hold down on the bed for 2 sec. and suddenly release.	No flexion within 5 sec. R L	Incomplete flexion of hips within 5 sec. R L	Complete flexion within 5 sec. R L	Instantaneous complete flexion R L	Legs cannot be extended; snap back forcefully R L
Leg Traction Infant supine. Grasp leg near ankle and slowly pull toward vertical until buttocks 2-3" off. Note resistance at knee and score angle. Do other leg.	No flexion R L	Partial flexion, rapidly lost R L	Knee flexion 140-160° and maintained R L	Knee flexion 100-140° and maintained R L	Strong resistance; flexion < 100° R L
Popliteal angle Infant supine. Approximate knee and thigh to abdomen; extend leg by gentle pressure with index finger behind ankle.	 160° R L	130° R L	110° R L	90° R L	< 90° R L
Head lag * Pull infant toward sitting posture by traction on both hands. Also note arm flexion.					
Ventral suspension * Hold infant in ventral suspension; observe relation of trunk to head, curvature of back and flexion of limbs.					
Head control (post. neck musc) Grasp infant by his shoulder and raise him to sitting position; allow head to fall forward; wait 30 sec.	No attempt to raise head	Head raised with vigorous jerk	Unsuccessful attempt to raise head upright	Head raised smoothly to upright position within 30 sec.	Head cannot be flexed forward
Head control (ant. neck musc) Allow head to fall backward as you hold shoulders; wait 30 sec.	Grading as above	Grading as above	Grading as above	Grading as above	
Head raising in prone position Infant in prone position with head in midline.	No response	Rolls head to one side	Weak effort to raise head and turns raised head to one side	Infant lifts head, nose and chin off	Strong prolonged head lifting
Arm release in prone position Head in midline. Infant in prone position, arms extended alongside body with palms up.	No effort	Some effort and wriggling	Flexion effort but neither wrist brought to nipple level	One or both wrists brought at least to nipple level without excessive body movement	Strong body movement with both wrists brought to face or 'press-ups'
Body movement during examination (spontaneous). If no spont. movement try to elicit by cutaneous stim.	None or minimal	A. Sluggish and infrequent B. Random, incoordinated movements.	Smooth alternating movements of arms and legs with medium speed and intensity	Smooth movements alternating with some jerky or athetoid ones	A. Mainly jerky movement. B. Athetoid movement.
Abnormal movement or posture		A. Hands clenched but open intermittently. B. Hands do not open with Moro.	A. Some mouthing movement. B. Intermittent adducted thumb	Continuous mouthing movement	A. Continuously adducted thumb B. Hands clenched all the time
Tremors	No tremor	Tremors only in state 5-6	Tremors only in sleep or after Moro and startles	Some tremors in state 4	Tremulousness in all states
Startles	No startles	Startles to sudden noise, Moro, bang on table only	Occasional spontaneous startle	2-5 spontaneous startles p = 0.03 compared with experimental	6+ spontaneous startles

						State	Cry	Asymm
REFLEXES								
Tendon reflexes Biceps jerk Knee jerk Ankle jerk	Absent		Present	Exaggerated	Clonus			
Palmar grasp Head in midline. Put index finger from ulnar side into hands & gently press palmar surface. Never touch dorsal side of hand	Absent	A. Asymmetrical. B. Short, weak flexion.	Medium strength and sustained flexion for several secs. No spread of contraction to forearm.	Strong flexion; contraction spreads to forearm	Very strong; infant easily lifts off couch			
Rooting Infant supine, head midline. Touch corner of the mouth (mucosa); stroke laterally 3 times.	No response	A. Partial weak head turn but no mouth opening. B. Mouth opening, no head turn.	Mouth opening on stimulated side with partial head turning	Mouth opening with full head turning	Mouth opening with very jerky head turning			
Sucking Infant supine; place index finger (pad towards palate) in infant's mouth; judge power of sucking movement after 5 sec.	No attempt	A. Regular but weak sucking. B. Irregular weak sucking movement.	Commencement of sucking delayed but regular and strong when established	Strong regular sucking movement with continuing sequence of 5 movements	A. Infant clenches but sucks when stimulated with finger. B. Clenching but no regular sucking.			
Walking Hold infant upright, feet touching bed, neck extended with finger.	Absent		Some effort but not continuous with both legs	At least 2 steps with both legs	A. Stork posture; no movement. B. Automatic walking.			
Moro One hand supports infant's head, the other the back. Raise infant to 45° and when infant is relaxed let his head fall through 10°.	No response	Full abduction at the shoulder and extension of the arm	Full abduction but only delayed or partial adduction	Partial abduction at shoulder and extension of arms followed by smooth adduction	A. Moro jerky. B. No abduction, only extension. C. Marked adduction only.			
								
NEUROBEHAVIOURAL ITEMS								
EYE APPEARANCES	Sunset sign Nerve palsy	Transient nystagmus. Strabismus. Some roving eye movement.	Does not open eyes	Normal conjugate eye movement	A. Persistent nystagmus. B. Frequent roving movement C. Frequent rapid blinks.			
AUDITORY ORIENTATION (state 3,4) To rattle	A. No reaction. B. Auditory startle but no true orientation.	Brightens and stills; may turn toward stimuli with eyes closed	Alerting and shifting of eyes; head may or may not turn to source	Alerting; prolonged head turns to stimulus; search with eyes	Turning and alerting on both sides; sometimes accompanied by startle			
VISUAL ORIENTATION (state 4) To red woollen ball	Does not focus or follow stimulus	Still focuses on stimulus, may follow 10° jerkily, does not find stimulus again spontaneously	Follows 30-60° horizontally; may lose stimulus but finds it again. Brief vertical glance	Follows with eyes and head horizontally and to some extent vertically, with frowning	Sustained fixation, follows vertically, horizontally, and in circle			
ALERTNESS (state 4)	Inattentive; rarely or never responds to direct stimulation	When alert, periods rather brief; rather variable response to orientation	When alert, alertness moderately sustained; may use stimulus to come to alert state	Sustained alertness; orientation frequent and reliable to visual but not auditory	Continuous alertness, which does not seem to tire, to both auditory and visual			
PEAK OF EXCITEMENT	Low level arousal to all stimuli; never > state 3	Infant reaches state 4-5 briefly but predominantly in lower states	Infant reaches state 6 after stimulation but returns spontaneously to lower state	Infant reaches state 6 but can be consoled relatively easily	A. Difficult to console, if at all. B. Stays in state 4-5 with all stimulations but if reaches state 6 cannot be consoled.			
IRRITABILITY (states 3,4,5) Aversive stimuli: Uncover / Ventral susp. Undress / Moro Pull to sit / Walking reflex Prone	No irritable crying to any of the stimuli	Cries to 1-2 stimuli	Cries to 3-4 stimuli	Cries to 5-6 stimuli	Cries to all stimuli			
CONSOLABILITY (state 6)	Never above state 3 during examination, therefore not needed	Consoling not needed. Consoles spontaneously	Consoled by talking, hand on belly or wrapping up	Consoled by picking up and holding; may need finger in mouth	Not consolable			
CRY	No cry at all	Only whimpering cry	Cries to stimuli but normal pitch	Lusty cry to offensive stimuli; normal pitch	High-pitched cry, often continuous			

NOTES * If asymmetrical or atypical, draw in on nearest figure

Record any abnormal signs (e.g. facial palsy, contractures, etc.). Draw if possible.

Record time after feed:

Examiner:

RACE	SEX	AGE	HEAD CIRC.	GESTATIONAL ASSESSMENT	SCORE	WEEKS

4. Awake, eyes open, minimal movement.
5. Wide awake, vigorous movement.
6. Crying.

APPENDIX II

☐ MARISS ☐ NON MARISS

HABITUATION (≤ state 3)						
Light Repetitive flashlight stimuli (10) with 5 sec. gap. Shutdown = 2 consecutive negative responses	No response	A. Blink response to first stimulus. B. Increasing response to repetitive stimuli. C. Variable response.	A. Shutdown of movement but blink persists 2-5 stimuli. B. Complete shutdown 2-5 stimuli.	A. Shutdown of movement but blink persists 6-10 stimuli. B. Complete shutdown 6-10 stimuli.	A. Equal response to 10 stimuli. B. Infant comes to fully alert state. C. Startles + major responses throughout.	
Rattle Repetitive stimuli (10) with 5 sec gap.	No response	Slight movement or blink to first stimulus	Startle or movement 2-5 stimuli, then shutdown	Startle or movement 6-10 stimuli, then shutdown	A. B. C. Grading as above	
MOVEMENT & TONE	uncover infant					
Posture (At rest – predominant) *			(hips abducted)	(hips adducted)	(opisthotonic)	
undress infant						
Arm Recoil Infant supine. Take both hands, extend parallel to the body; release quickly.	No flexion within 5 sec. R L	Partial flexion at elbow >100° within 4-5 sec. R L	Arms flex at elbow to <100° within 2-3 sec. R L	Sudden jerky flexion at elbow immediately after release to <60° R L	Difficult to extend; arm snaps back forcefully	
Arm Traction Infant supine; head midline; grasp wrist, slowly pull arm to vertical. Angle of arm scored and resistance noted at moment infant is initially lifted off and watched until shoulder off mattress. Do other arm.	Arm remains fully extended R L	Weak flexion maintained only momentarily R L	Arm flexed at elbow to 140° and maintained 5 sec. R L	Arm flexed at approx. 100° and maintained R L	Strong flexion of arm < 100° and maintained R L	
Leg Recoil First flex hips for 5 sec, then extend both legs of infant by traction on ankles; hold down on the bed for 3 sec. and suddenly release.	No flexion within 5 sec. R L	Incomplete flexion of hips within 5 sec. R L	Complete flexion within 5 sec. R L	Instantaneous complete flexion R L	Legs cannot be extended; snap back forcefully R L	Significant p = .005
Leg Traction Infant supine. Grasp leg near ankle and slowly pull toward vertical until buttocks 2-3" off. Note resistance at knee and score angle. Do other leg.	No flexion R L	Partial flexion, rapidly lost R L	Knee flexion 140-160° and maintained R L	Knee flexion 100-140° and maintained R L	Strong resistance; flexion <100° R L	Significant p = .05
Popliteal angle Infant supine. Approximate knee and thigh to abdomen; extend leg by gentle pressure with index finger behind ankle.	160° R L	130° R L	110° R L	90° R L	<90° R L	Significant p = .02
Head lag * Pull infant toward sitting posture by traction on both hands. Also note arm flexion.						
Ventral suspension * Hold infant in ventral suspension; observe relation of trunk to head, curvature of back and flexion of limbs.						
Head control (post neck musc) Grasp infant by his shoulder and raise him to sitting position; allow head to fall forward; wait 30 sec.	No attempt to raise head	Head raised with vigorous jerk	Unsuccessful attempt to raise head upright	Head raised smoothly to upright position within 30 sec.	Head cannot be flexed forward	
Head control (ant. neck musc) Allow head to fall backward as you hold shoulders; wait 30 sec.	Grading as above	Grading as above	Grading as above	Grading as above		
Head raising in prone position Infant in prone position with head in midline.	No response	Rolls head to one side	Weak effort to raise head and turns raised head to one side	Infant lifts head, nose and chin off	Strong prolonged head lifting	Significant p = .00[illegible]
Arm release in prone position Head in midline. Infant in prone position; arms extended alongside body with palms up.	No effort	Some effort and wriggling	Flexion effort but neither wrist brought to nipple level	One or both wrists brought at least to nipple level without excessive body movement	Strong body movement with both wrists brought to face or 'press-ups'	Significant p = .02
Body movement during examination (spontaneous). If no spont. movement try to elicit by cutaneous stim.	None or minimal	A. Sluggish and infrequent. B. Random, incoordinated movements.	Smooth alternating movements of arms and legs with medium speed and intensity	Smooth movements alternating with some jerky or athetoid ones	A. Mainly jerky movement. B. Athetoid movement	Significant p = .01
Abnormal movement or posture		A. Hands clenched but open intermittently. B. Hands do not open with Moro.	A. Some mouthing movement. B. Intermittent adducted thumb	Continuous mouthing movement	A. Continuously adducted thumb. B. Hands clenched all the time	
Tremors	No tremor	Tremors only in state 5-6	Tremors only in sleep or after Moro and startles	Some tremors in state 4	Tremulousness in all states	
Startles	No startles	Startles to sudden noise, Moro, bang on table only	Occasional spontaneous startle	2-5 spontaneous startles	6+ spontaneous startles	

APPENDIX II (cont'd)

State | Cry | Record

REFLEXES

Tendon reflexes Biceps jerk Knee jerk Ankle jerk	Absent		Present	Exaggerated	Clonus
Palmar grasp Head in midline. Put index finger from ulnar side into hand & gently press palmar surface. Never touch dorsal side of hand.	Absent	A. Asymmetrical. B. Short, weak flexion.	Medium strength and sustained flexion for several secs. No spread of contraction to forearm.	Strong flexion; contraction spreads to forearm	Very strong; infant easily lifts off couch
Rooting Infant supine, head midline. Touch corner of the mouth (mucosa); stroke laterally 3 times.	No response	A. Partial weak head turn but no mouth opening. B. Mouth opening no head turn.	Mouth opening on stimulated side with partial head turning	Mouth opening with full head turning	Mouth opening with very jerky head turning
Sucking Infant supine; place index finger (pad towards palate) in infant's mouth; judge power of sucking movement after 5 sec.	No attempt	A. Regular but weak sucking. B. Irregular weak sucking movement.	Commencement of sucking delayed but regular and strong when established	Strong regular sucking movement with continuing sequence of 5 movements.	A. Infant clenches but sucks when stimulated with finger. B. Clenching but no regular sucking.
Walking Hold infant upright, feet touching bed, neck extended with finger.	Absent		Some effort but not continuous with both legs	At least 2 steps with both legs	A. Stork posture; no movement. B. Automatic walking.
Moro One hand supports infant's head, the other the back. Raise infant to 45° and when infant is relaxed let his head fall through 10°.	No response	Full abduction at the shoulder and extension of the arm	Full abduction but only delayed or partial adduction	Partial abduction at shoulder and extension of arms followed by smooth adduction	A. Moro jerky. B. No abduction, only extension. C. Marked adduction only

NEUROBEHAVIOURAL ITEMS

EYE APPEARANCES	Sunset sign Nerve palsy	Transient nystagmus. Strabismus. Some roving eye movement.	Does not open eyes	Normal conjugate eye movement	A. Persistent nystagmus. B. Frequent roving movement C. Frequent rapid blinks.
AUDITORY ORIENTATION (state 3,4) To rattle	A. No reaction. B. Auditory startle but no true orientation.	Brightens and stills; may turn toward stimuli with eyes closed	Alerting and shifting of eyes; head may or may not turn to source	Alerting; prolonged head turns to stimulus; search with eyes	Turning and alerting on both sides; sometimes accompanied by startle
VISUAL ORIENTATION (state 4) To red woollen ball	Does not focus or follow stimulus	Still focuses on stimulus, may follow 30° jerkily, does not find stimulus again spontaneously	Follows 30-60° horizontally, may lose stimulus but finds it again. Brief vertical glance	Follows with eyes and head horizontally and to some extent vertically, with frowning	Sustained fixation; follows vertically, horizontally, and in circle
ALERTNESS (state 4)	Inattentive; rarely or never responds to direct stimulation	When alert, periods rather brief, rather variable response to orientation	When alert, alertness moderately sustained, may use stimulus to come to alert state	Sustained alertness; orientation frequent, reliable to visual but not auditory	Continuous alertness, which does not seem to tire, to both auditory and visual
PEAK OF EXCITEMENT	Low level arousal to all stimuli; never > state 3	Infant reaches state 4-5 briefly but predominantly in lower states	Infant reaches state 4-5 after stimulation but returns spontaneously to lower state	Infant reaches state 6 but can be consoled relatively easily	A. Difficult to console, if at all. B. Stays in state 4-5 with all stimulations but if reaches state 6 cannot be consoled.
IRRITABILITY (states 3,4,5) Aversive stimuli: Uncover — Ventral susp. Undress — Moro Pull to sit — Walking reflex Prone	No irritable crying to any of the stimuli	Cries to 1-2 stimuli	Cries to 3-4 stimuli	Cries to 5-6 stimuli	Cries to all stimuli
CONSOLABILITY (state 6)	Never above state 3 during examination, therefore not needed	Consoling not needed. Consoles spontaneously	Consoled by talking, hand on belly or wrapping up	Consoled by picking up and holding; may need finger in mouth	Not consolable
CRY	No cry at all	Only whimpering cry	Cries to stimuli but normal pitch	Lusty cry to offensive stimuli; normal pitch	High pitched cry, often continuous

Significant
p = .04

NOTES * If asymmetrical or atypical, draw in on nearest figure
Record any abnormal signs (e.g. facial palsy, contractures, etc.). Draw if possible.

Record time after feed:

Examiner:

HOSP.	NO.	DATE OF EXAM	HEIGHT	
DATE	SEX	AGE	HEAD CIRC.	GESTATIONAL ASSESSMENT SCORE WEEKS

3. [illegible]
4. Awake, eyes open, minimal movement.
5. Wide awake, vigorous movement.
6. Crying.

APPENDIX - III

☐ - MARISS 1 ☐ - MARISS 2

HABITUATION (≤ state 3)					
Light Repetitive flashlight stimuli (10) with 5 sec. gap. Shutdown = 2 consecutive negative responses	No response	A. Blink response to first stimulus. B. Increasing response to repetitive stimuli. C. Variable response.	A. Shutdown of movement but blink persists 2-5 stimuli. B. Complete shutdown 2-5 stimuli.	A. Shutdown of movement but blink persists 6-10 stimuli. B. Complete shutdown 6-10 stimuli.	A. Equal response to 10 stimuli. B. Infant comes to fully alert state. C. Startles + major responses throughout. Significant $p < .03$
Rattle Repetitive stimuli (10) with 5 sec gap.	No response	Slight movement to first stimulus	Startle or movement 2-5 stimuli, then shutdown	Startle or movement 6-10 stimuli, then shutdown	A. B. C. Grading as above
MOVEMENT & TONE	Uncover infant				
Posture (At rest - predominant) *			(hips abducted)	(hips adducted)	(opisthotonic)
Undress infant					
Arm Recoil Infant supine. Take both hands, extend parallel to the body; release quickly.	No flexion within 5 sec. R L	Partial flexion at elbow > 100° within 4-5 sec. R L	Arms flex at elbow to < 100° within 2-3 sec. R L	Sudden jerky flexion at elbow immediately after release to < 60° R L	Difficult to extend; arm snaps back forcefully. $p \leq 0.05$
Arm Traction Infant supine; head midline; grasp wrist, slowly pull arm to vertical. Angle of arm scored and resistance noted at moment infant is initially lifted off and watched until shoulder off mattress. Do other arm.	Arm remains fully extended R L	Weak flexion maintained only momentarily R L	Arm flexed at elbow to 140° and maintained 5 sec. R L	Arm flexed at approx. 100° and maintained R L	Strong flexion of arm < 100° and maintained R L
Leg Recoil First flex hips for 5 sec, then extend both legs of infant by traction on ankles; hold down on the bed for 2 sec. and suddenly release.	No flexion within 5 sec. R L	Incomplete flexion of hips within 5 sec. R L	Complete flexion within 5 sec. R L	Instantaneous complete flexion R L	Legs cannot be extended; snap back forcefully R L. Significant $p < .001$
Leg Traction Infant supine. Grasp leg near ankle and slowly pull toward vertical until buttocks 1-2" off. Note resistance at knee and score angle. Do other leg.	No flexion R L	Partial flexion, rapidly lost R L	Knee flexion 140-160° and maintained R L	Knee flexion 100-140° and maintained R L	Strong resistance; flexion < 100° R L
Popliteal angle Infant supine. Approximate knee and thigh to abdomen, extend leg by gentle pressure with index finger behind ankle.	160° R L	130° R L	110° R L	90° R L	< 90° R L
Head lag * Pull infant toward sitting posture by traction on both hands. Also note arm flexion.					
Ventral suspension * Hold infant in ventral suspension; observe relation of trunk to head, curvature of back and flexion of limbs.					
Head control (post. neck musc) Grasp infant by his shoulder and raise him to sitting position; allow head to fall forward; wait 30 sec.	No attempt to raise head	Head raised with vigorous jerk	Unsuccessful attempt to raise head upright	Head raised smoothly to upright position within 30 sec.	Head cannot be flexed forward
Head control (ant. neck musc) Allow head to fall backward as you hold shoulders; wait 30 sec.	Grading as above	Grading as above	Grading as above	Grading as above	
Head raising in prone position Infant in prone position with head in midline.	No response	Rolls head to one side	Weak effort to raise head and turns raised head to one side	Infant lifts head, nose and chin off	Strong prolonged head lifting
Arm release in prone position Head in midline. Infant in prone position; arms extended alongside body with palms up.	No effort	Some effort and wriggling	Flexion effort but neither wrist brought to nipple level	One or both wrists brought at least to nipple level without excessive body movement	Strong body movement with both wrists brought to face or 'press-ups'
Body movement during examination (spontaneous). If no spont. movement try to elicit by cutaneous stim.	None or minimal	A. Sluggish and infrequent B. Random, incoordinated movements.	Smooth alternating movements of arms and legs with medium speed and intensity	Smooth movements alternating with random jerky or athetoid ones	A. Mainly jerky movement. B. Athetoid movement.
Abnormal movement or posture		A. Hands clenched but open intermittently. B. Hands do not open with Moro.	A. Some mouthing movement. B. Intermittent adducted thumb	Continuous mouthing movement	A. Continuously adducted thumb. B. Hands clenched all the time
Tremors	No tremor	Tremors only in state 5-6	Tremors only in sleep or after Moro and startles	Some tremors in state 4	Tremulousness in all states
Startles	No startles	Startles to sudden noise, Moro, bang on table only	Occasional spontaneous startle	2-5 spontaneous startles	6+ spontaneous startles

APPENDIX III (cont'd)

Significant p < .001

REFLEXES

Tendon reflexes Biceps jerk Knee jerk Ankle jerk	Absent		Present	Exaggerated	Clonus
Palmar grasp Head in midline. Put index finger from ulnar side into hand & gently press palmar surface. Never touch dorsal side of hand.	Absent	A. Asymmetrical. B. Short, weak flexion.	Medium strength and sustained flexion for several secs. No spread of contraction to forearm.	Strong flexion; contraction spreads to forearm	Very strong; infant easily lifts off couch
Rooting Infant supine, head midline. Touch corner of the mouth (mucosa); stroke laterally 3 times.	No response	A. Partial weak head turn but no mouth opening. B. Mouth opening, no head turn.	Mouth opening on stimulated side with partial head turning	Mouth opening with full head turning	Mouth opening with very jerky head turning
Sucking Infant supine; place index finger (pad towards palate) in infant's mouth; judge power of sucking movement after 5 sec.	No attempt	A. Regular but weak sucking. B. Irregular weak sucking movement.	Commencement of sucking delayed but regular and strong when established	Strong regular sucking movement with continuing sequence of 5 movements.	A. Infant clenches but sucks when stimulated with finger. B. Clenching but no regular sucking.
Walking Hold infant upright, feet touching bed, neck extended with finger.	Absent		Some effort but not continuous with both legs	At least 2 steps with both legs	A. Stork posture; no movement. B. Automatic walking.
Moro One hand supports infant's head, the other the back. Raise infant to 45° and when infant is relaxed let his head fall through 10°.	No response	Full abduction at the shoulder and extension of the arm	Full abduction but only delayed or partial adduction	Partial abduction at shoulder and extension of arms followed by smooth adduction	A. Moro jerky. B. No adduction, only extension. C. Marked adduction only.

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Record time after food:

Examiner:

Appendices Ia, IIa, IIIa - Differences (T-test) in Infants Variables as measured at 40 weeks (Life Age)

Groups		Habituation		Movement and Tone						
		Light	Rattle	Posture	Arm recoil	Arm traction	Leg recoil	Leg traction	Poplital angle	Head Lag
Intervention	Mean	2.5	3.1	3.0	2.8	3.2	3.4	3.5	3.4	3.4
versus	S.D.	1.3	1.3	0.6	0.6	0.8	0.7	0.8	0.8	0.6
	P of T	0.2	0.09	0.2	0.7	0.07	0.005*	0.05*	0.02*	0.4
Non -	Mean	3.3	4.0	2.8	2.7	2.7	2.7	3.0	2.9	3.3
Intervention	S.D.	1.6	1.2	0.6	0.5	0.6	0.6	0.5	0.5	0.5
Intervention	Mean	3.1	3.2	3.0	3.0	3.4	3.7	3.7	3.7	3.7
- 1	S.D.	1.2	1.3	0.6	0.4	0.6	0.4	0.6	0.7	0.5
versus	P	0.03*	0.9	0.7	0.05*	0.1	0.001*	0.1	0.07	0.07
Intervention	Mean	1.9	3.1	3.1	2.5	2.9	2.9	3.2	3.1	3.2
- 2	S.D.	1.0	1.3	0.7	0.7	0.9	0.6	0.9	0.7	0.6
Intervention	Mean	3.1	3.2	3.0	3.0	3.4	3.7	3.7	3.7	3.7
- 1	S.D.	1.2	1.3	0.6	0.4	0.6	0.4	0.6	0.7	0.5
versus	P	0.7	0.2	0.4	0.1	0.01	0.000*	0.003*	0.003*	0.05*
Non -	Mean	3.3	4.0	2.8	2.7	2.7	2.7	3.0	2.8	3.3
Intervention	S.D.	1.6	1.2	0.6	0.5	0.6	0.6	0.5	0.5	0.5
Intervention	Mean	1.9	3.1	3.1	2.5	2.9	2.9	3.2	3.1	3.2
- 2	S.D.	1.0	1.3	0.7	0.7	0.9	0.6	0.9	0.7	0.6
versus	P	0.04*	0.1	0.2	0.4	0.5	0.5	0.5	0.4	0.7
Non -	Mean	3.3	4.0	2.8	2.7	2.7	2.7	3.0	2.9	3.3
Intervention	S.D.	1.6	1.2	0.6	0.5	0.6	0.6	0.5	0.5	0.5
Intervention	Mean	3.1	3.1	3.0	2.8	3.2	3.4	3.5	3.4	3.4
versus	S.D.	1.3	1.3	0.6	0.6	0.8	0.6	0.8	0.8	0.6
	P	0.9	0.9	0.03*	0.2	0.3	0.9	0.6	0.7	0.3
Full -	Mean	3.1	3.1	3.7	3.1	3.5	3.4	3.7	3.3	3.2
Term (n=7)	S.D.	1.2	1.2	0.7	0.6	0.8	0.5	0.9	0.9	0.6
Non -	Mean	3.3	4.0	2.8	2.7	2.7	2.7	3.0	2.8	3.3
Intervention	S.D.	1.6	1.2	0.6	0.5	0.6	0.6	0.5	0.5	0.5
versus	P	0.4	0.2	0.04*	0.09	0.008*	0.009*	0.03*	0.1	0.7
Full -	Mean	2.8	3.1	3.7	3.1	3.5	3.4	3.7	3.3	3.2
Term	S.D.	1.2	1.2	0.7	0.6	0.7	0.5	0.9	0.9	0.6

Groups								Reflexes				
		Ventral Suspension	Head Control (Post-neck)	Head Control (Ante neck)	Head Raising (Prone)	Arm release (Prone)	Body Movement	Tremors	Startles	Palmar Grasp	Rooting	Sucking
Intervention	Mean	3.3	3.5	3.5	2.9	3.8	3.0	1.7	1.4	3.5	2.9	3.6
versus	S.D.	0.6	0.7	0.7	1.1	0.6	0.6	1.0	0.8	0.9	0.9	0.6
	P of T	0.6	0.2	0.3	0.01*	0.02*	0.01*	0.3	0.1	0.3	0.5	0.2
Non -	Mean	3.2	3.1	3.3	1.7	2.9	2.4	1.4	1.1	3.1	2.7	3.3
Intervention	S.D.	0.7	0.9	0.6	0.6	1.2	0.7	0.5	0.3	1.2	0.7	0.5
Intervention	Mean	3.5	3.7	3.7	2.8	4.0	3.2	1.9	1.5	4.1	3.2	3.7
- 1	S.D.	0.7	0.4	0.4	1.1	0.4	0.6	1.1	1.0	0.8	0.7	0.5
versus	P	0.1	0.1	0.2	0.9	0.2	0.3	0.4	0.4	0.001*	0.08	0.7
Intervention	Mean	3.1	3.2	3.3	2.9	3.6	2.9	1.5	1.2	2.8	2.6	3.6
- 2	S.D.	0.6	0.9	0.9	1.1	0.8	0.6	0.9	0.4	0.8	0.9	0.7
Intervention	Mean	3.5	3.7	3.7	2.8	4.0	3.2	1.9	1.5	4.1	3.2	3.7
- 1	S.D.	0.7	0.4	0.4	1.1	0.4	0.6	1.1	1.0	0.8	0.7	0.5
versus	P	0.2	0.04*	0.05*	0.002*	0.006*	0.01*	0.1	0.2	0.03*	0.1	0.2
Non -	Mean	3.2	3.1	3.3	1.6	2.9	2.4	1.4	1.1	3.1	2.7	3.3
Intervention	S.D.	0.7	0.9	0.6	0.6	1.2	0.7	0.5	0.3	1.2	0.7	0.8
Intervention	Mean	3.1	3.2	3.3	2.9	3.6	2.9	1.5	1.2	2.8	2.6	3.6
- 2	S.D.	0.6	0.9	0.9	1.6	0.8	0.6	0.9	0.4	0.8	0.9	0.7
versus	P	0.7	0.9	0.9	0.002	0.1	0.09	0.8	0.4	0.4	0.7	0.4
Non -	Mean	3.2	3.1	3.3	1.6	2.9	2.4	1.4	1.1	3.1	2.7	3.3
Intervention	S.D.	0.7	0.9	0.6	0.6	1.2	0.7	0.5	0.3	1.2	0.7	0.8
Intervention	Mean	3.3	3.5	3.5	2.9	3.8	3.0	1.7	1.4	3.5	2.9	3.6
versus	S.D.	0.6	0.7	0.7	1.1	0.6	0.6	1.0	0.8	0.9	0.9	0.6
	P	0.8	0.5	0.4	0.5	0.7	0.3	0.6	0.03*	0.4	0.2	0.5
Full -	Mean	3.3	3.3	3.3	3.1	3.7	2.7	1.5	2.1	3.1	3.5	3.8
Term (n=7)	S.D.	0.7	0.8	0.8	0.6	1.3	1.2	0.5	0.9	0.9	1.3	0.6
Non -	Mean	3.2	3.1	3.3	1.6	2.9	2.4	1.4	1.1	3.1	2.7	3.3
Intervention	S.D.	0.7	0.9	0.6	0.6	1.2	0.7	0.5	0.3	1.2	0.7	0.8
versus	P	0.8	0.6	0.9	0.000*	0.1	0.5	0.6	0.01*	0.9	0.1	0.1
Full -	Mean	3.3	3.3	3.3	3.1	3.7	2.7	1.5	2.1	3.1	3.5	3.8
Term	S.D.	0.8	0.8	0.8	0.6	1.3	1.2	0.5	0.9	0.9	1.3	0.6

Groups		Neurobehavioural Items							
		Walking	Auditory Orientation	Visual Orientation	Alertness	Peak of Excitement	Irritability	Consolability	Cry
Intervention	Mean	3.7	2.7	2.2	4.0	3.6	2.5	3.3	2.5
versus	S.D.	0.9	1.3	1.1	0.7	0.7	1.3	0.9	0.8
	P of T	0.6	0.1	0.7	0.2	0.3	0.04*	0.6	0.5
Non -	Mean	3.5	2.0	2.1	3.7	3.9	3.5	3.8	2.8
Intervention	S.D.	0.8	1.3	0.9	0.8	0.9	1.3	0.7	1.1
Intervention	Mean	3.7	3.0	2.6	4.3	3.7	2.6	3.1	2.7
- 1	S.D.	0.9	1.3	1.2	0.8	0.7	1.4	1.1	0.9
versus	P	0.7	0.3	0.09	0.1	0.8	0.7	0.5	0.4
Intervention	Mean	3.6	2.3	1.8	3.8	3.6	2.4	3.4	2.4
- 2	S.D.	1.0	1.3	0.7	0.6	0.7	1.2	0.7	0.5
Intervention	Mean	3.7	3.0	2.6	4.3	3.7	2.6	3.1	2.7
- 1	S.D.	0.9	1.3	1.2	0.8	0.7	1.4	1.1	0.9
versus	P	0.5	0.07	0.3	0.08	0.5	1.2	0.08	0.8
Non -	Mean	3.5	2.0	2.1	3.7	3.9	3.5	3.8	2.8
Intervention	S.D.	0.5	1.3	0.9	0.8	0.9	1.3	0.7	1.1
Intervention	Mean	3.6	2.3	1.8	3.8	3.6	2.4	3.4	2.4
- 2	S.D.	1.0	1.3	0.7	0.6	0.7	1.2	0.7	0.5
versus	P	0.9	0.6	0.4	0.7	0.4	0.05*	0.2	0.3
Non -	Mean	3.5	2.0	2.1	3.7	3.9	3.5	3.8	2.8
Intervention	S.D.	0.5	1.3	0.9	0.8	0.9	1.3	0.7	1.1
Intervention	Mean	3.7	2.7	2.2	4.0	3.6	2.5	3.3	2.5
versus	S.D.	0.9	1.3	1.1	0.7	0.7	1.3	0.9	0.8
	P	0.7	0.04*	0.8	0.001*	0.9	0.3	0.7	0.1
Full -	Mean	3.8	1.6	2.1	2.9	3.7	3.0	3.4	3.1
Term (n=7)	S.D.	0.6	0.9	0.7	0.8	1.1	0.9	0.9	1.2
Non -	Mean	3.5	2.0	2.1	3.7	3.9	3.5	3.8	2.8
Intervention	S.D.	0.5	1.3	0.9	0.8	0.9	1.3	0.7	1.1
versus	P	0.3	0.4	0.9	0.04*	0.6	0.3	0.2	0.5
Full -	Mean	3.8	1.6	2.1	2.9	3.7	3.0	3.4	3.1
Term	S.D.	0.6	0.9	0.7	0.8	1.1	0.9	0.9	1.2

Step-by-Step Illustrations for Administering THE LOVING TOUCH. Refer to This Chart While You Listen to Side 1 of the Tape.

1. If your baby is small, place him on your lap while you are seated in a low comfortable chair. If your baby is too large for your lap, use a padded table or a blanket on the floor.

2. Undress your baby. Place a light-weight blanket under him and have a diaper nearby in case you need it. Babies frequently urinate during the massage because their sphincter muscles relax.

3. *Make sure your nails are smooth and cut short.* You may use lotion, cream or a baby oil on your hands to make them glide more smoothly.

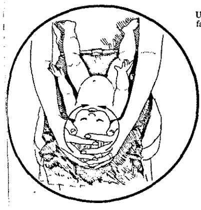
4. **All movements are to be repeated 3 times. The massaging should last 10 minutes and may be given 3 or 4 times a day. The rocking should last 5 minutes.**

5. Use a light, but firm touch. Do not pull the skin. The purpose of THE LOVING TOUCH is not a deep muscle massage, but rather a stimulating stroking of the skin.

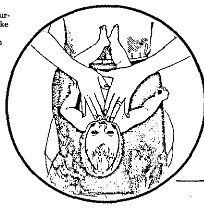
6. Make eye contact and talk to your baby while giving the massage. You are now providing your baby with three very important kinds of stimulation—touch, visual and auditory. When you swaddle (wrap snugly) and rock your baby as shown in Step 18, you will be providing vestibular stimulation which has been found to be neurologically beneficial.

REMEMBER, REPEAT EACH STEP 3 TIMES BEFORE PROCEEDING TO THE NEXT STEP.

Step 1

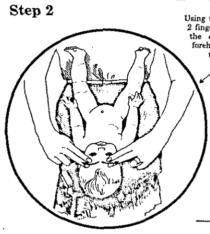


Step 1B



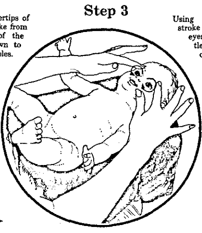
Using the entire palm surface of your hands, stroke from the top of the head down to the chin as shown in **Step 1B**.

Step 2



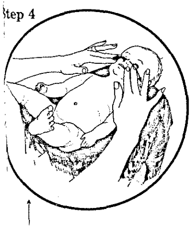
Using the fingertips of 2 fingers, stroke from the center of the forehead down to the temples.

Step 3



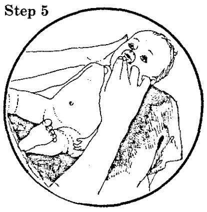
Using a fingertip, stroke around the eyes, pressing a little more firmly on the *inside* of the bridge of the nose, near the inside corner of the eye.

Step 4



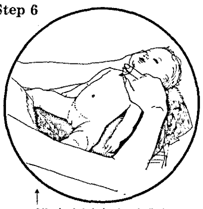
Using 2 fingertips, stroke from the bridge of the nose, out over the cheeks, over the ears.

Step 5



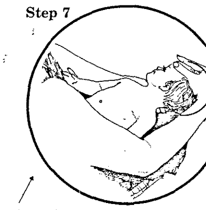
Using a fingertip, stroke around the mouth.

Step 6



Lift the baby's head and tilt it slightly back, supporting it with your hand. Using 2 fingertips, stroke over the chin and down the throat.

Step 7

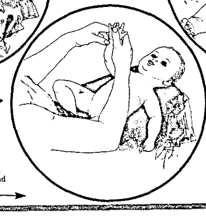


While one hand is supporting the baby's head, use the opposite hand to stroke the baby's head. Starting at the forehead, stroke the entire head to the nape of the neck. If your baby has a lot of thick hair, stroking the hair might pull and be uncomfortable. Place your fingertips under the hair on the scalp and massage the skin (much like they do at the beauty shop when your hair is shampooed).

turn over→

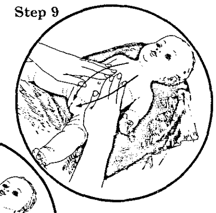
Step 8

Step 8B



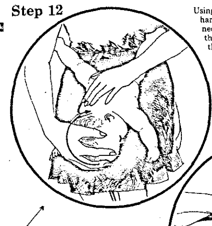
Raise the baby's arm and support it with your hand. With your other hand, encircle the baby's arm and with a rotating, circling motion, massage the entire arm. Press firmly on the baby's palm with your thumb as you finish the massage of the arm as shown in **Step 8B**. Repeat **Steps 8** and **8B** with the other arm.

Step 9



Using the entire palm surface of the hands, stroke from the neck down over the chest and abdomen. Cover as much of the skin surface with your hands as possible. The baby's genitalia are stroked also as your hands move down over the baby's tummy in one smooth, gliding movement.

Step 12

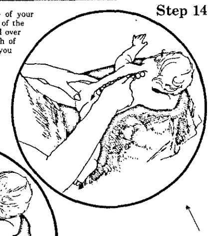


Turn the baby over and massage his scalp again. Spread your fingers so that you can cover as much skin surface as possible, massage from the forehead to the nape of the neck. Follow the instructions given in **Step 7** if your baby has a lot of hair.

Step 13

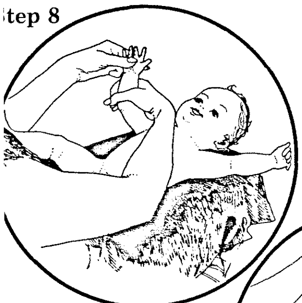
Using the entire palm surface of your hands, stroke from the nape of the neck down over the back and over the buttocks. Cover as much of the baby's skin surface as you can.

Step 14



Using 2 fingertips, manipulate and massage the entire spine. Use a slightly firmer touch, rotate your fingers in a circular motion as you gently manipulate the spinal bones.

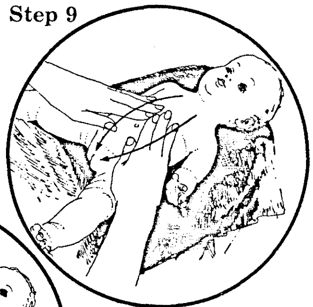
‹tep 8



Step 8B

‹ise the baby's arm and sup-
‹rt it with your hand. With
‹ur other hand, encircle the
‹by's arm and with a rotat-
‹, circling motion, massage the
‹tire arm. Press firmly on the
‹by's palm with your thumb as
‹ finish the massage of the arm as
‹own in **Step 8B**. Repeat **Steps 8** and
with the other arm.

Step 9

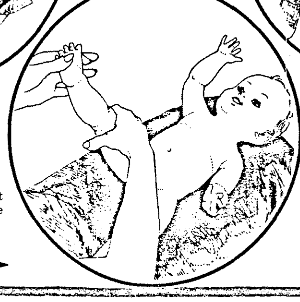


Using the entire palm surface of the hands, stroke from the neck down over the chest and abdomen. Cover as much of the skin surface with your hands as possible. The baby's genitalia are stroked also as your hands move down over the baby's tummy in one smooth, gliding movement.

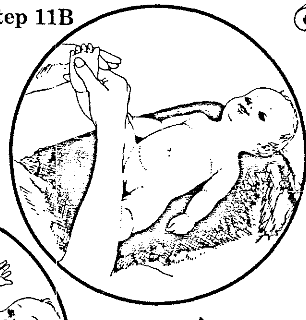
Step 10

With 2 fingertips, stroke the midline (called the *linea alba*), starting at the neck, stroke down the center of the trunk, over the genitalia.

Step 11

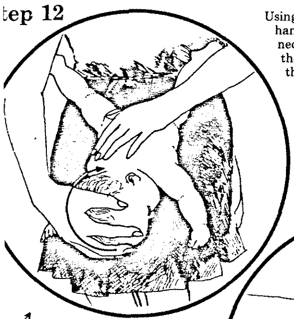


Step 11B



Support the baby's leg with your hand and with your other hand, encircle the leg. With a rotating, encircling motion stroke the entire leg. Press firm‹ly on the sole of the baby's foo‹ with your thumb as shown in **Step 11B**

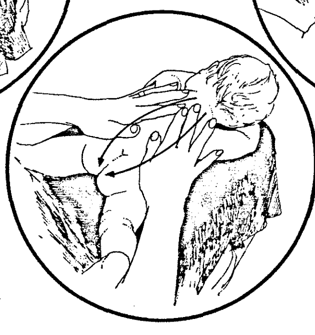
‹ep 12



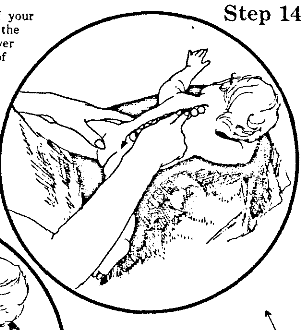
‹rn the baby over and mas-
‹e his scalp again. Spread
‹r fingers so that you can
‹er as much skin surface as
‹sible, massage from the fore-
‹d to the nape of the neck. Fol-
‹ the instructions given in **Step 7**
‹our baby has a lot of hair.

Using the entire palm surface of your hands, stroke from the nape of the neck down over the back and over the buttocks. Cover as much of the baby's skin surface as you can.

Step 13

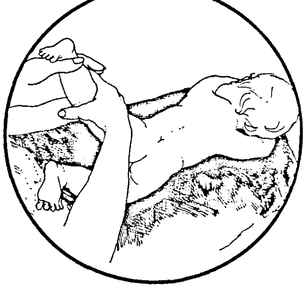


Step 14



Using 2 fingertips, manipulate and massage the entire spine. Use a slightly firmer touch, rotate your fingers in a circular motion as you gently manipulate the spinal bones.

Step 15



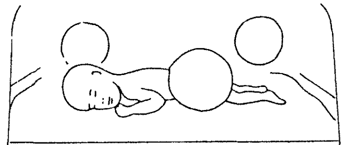
Support the baby's leg with your hand while you encircle his leg with your other hand, massage the entire leg as in **Step 11**. Press firmly on the sole of the foot with your thumb as in **Step 11B**. Repeat with the other leg.

Step 16

Turn the baby over and wrap him snugly in the blanket. We call this "swaddling." Continue to make eye contact. Rock your baby for at least 5 minutes. We have found that a vigorous rock is more stimulating than a slow rocking motion. Continue to talk, sing or hum to your baby. Or you may want to turn the tape over to Side 2 and play the intrauterine sounds while he drifts off to a deep sleep.

The Loving
CRADLE CARE, INC.
P.O. Box 401548
Dallas, Texas

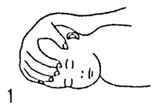
Macedo Adaptation of Rice Infant Sensorimotor Stimulation -MARISS-



PRONE POSITION IN INCUBATOR

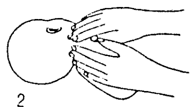
STEP BY STEP ILLUSTRATIONS

1. Start without moving your baby from his/her resting position whether in incubator or in the cot
2. Before undressing your baby, gently stroke his/her head from the forehead to the neck (see picture 1)
3. Have a nappy handy in case you need it, since the stroking often relaxes the sphincter muscles
4. Make sure your nails are smooth and cut short
5. Repeat the first movement (see picture 1) six times. All the other movements should be repeated three times. The stroking should last for ten minutes
6. Use a "butterfly" but firm touch. Do not pull the skin



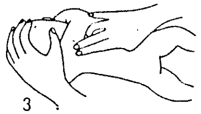
1

Using your hand, rest your fingers gently on your baby's forehead and stroke the entire head, from the forehead to the nape of the neck. If your baby has a lot of hair stroking it might pull and be uncomfortable. Instead, place your fingertips under the hair on the scalp and stroke the skin gently. This is the only movement which you repeat 6 times



2

Undress your baby gently. Using the entire surface of the palms of the hands, stroke from the nape of the neck down and over the buttocks. Cover as much of the baby's skin as possible. If the baby is very tiny you may use one hand only

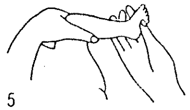


3

Using two fingertips stroke the entire length of the spine with light but firm circular movements from the nape of the neck down, up and down again. Feel the gentle manipulation of the spinal bones

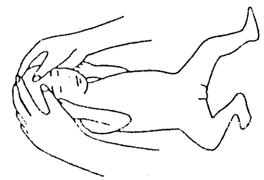
4

Support the baby's leg with one hand and with the other hand, stroke the entire leg with a rotating, encircling movement



5

Press firmly on the sole of the baby's foot with your thumb. Do the same with both legs



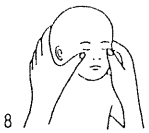
6

Gently turn the baby over to lie in the supine position. Using the palms of your hands and crossing your fingers on the top of his/her head, stroke from the top of the baby's head down to the chin

SUPINE POSITION

7

Support both sides of your baby's head with your hands and using two fingertips of each hand, stroke from the centre of the forehead out to the temples

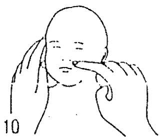


8

Gently supporting the head with your hands, use your thumbs to stroke around the eyes, pressing a little more firmly on the inside of the bridge of the nose, near the inside corner of the eye

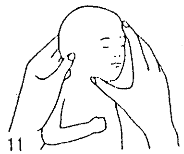
9

Support the head with your hands and use your thumb to gently stroke from the bridge of the nose out over the cheeks and ears



10

Using a fingertip, stroke around the mouth



11

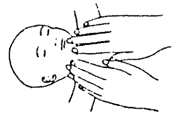
Gently tilt the baby's head and tilt it slightly back. Using your thumb, stroke over the chin and down the throat. Stroke also both sides of the throat

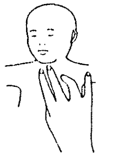
12

Raise your baby's arm and support it with one hand. With the other hand encircle the baby's arm and with a rotating circling motion stroke the entire arm. Press firmly on the baby's palm with your thumb as you finish the stroking of the arm. Do the same with the other arm

13

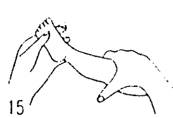
Using the palms of your hands, stroke down from the neck over the chest and abdomen. Cover as much of the skin surface with your hands as possible. The baby's genitalia are also stroked as your hands move down over the baby's tummy in one smooth, gliding movement





14

With two fingertips, stroke the midline (called linea alba), starting at the neck down the centre of trunk, over the genitalia



15

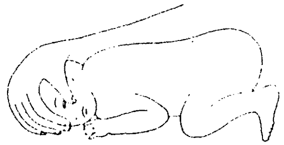
Support the baby's leg with one hand and encircle it with the other hand. With a rotating, encircling motion, stroke the entire leg. Press firmly on the sole of the baby's foot with your thumb

16

Place your whole hand gently on the baby's head with your fingers touching his/her forehead, close to his/her nose so that the baby can sense your smell

17

Dress your baby and turn him/her to the prone position.
This is the end of the stroking sequence; your baby will be relaxed



COMFORT POSITION

Appendix VI.

Complementary Study (TAC-TIC).

VI.1 Principles of TAC-TIC.

TAC-TIC is a Tender-Tactile-Touching approach to communication between mothers/fathers/caretakers and (primarily) premature, but also full-term babies, during the first 3-weeks and onwards. Its origin is to be found in Rice Infant Sensorimotor Stimulation, 1977, (R.I.S.S.), in the Macedo Adaptation of Rice Infant Sensorimotor Stimulation (MARISS), 1980, and the responses of the babies themselves. Its scientific roots can be found in the bibliography of both authors. As MARISS was developed from R.I.S.S. and adapted firstly for the conditions of babies in incubators, so TAC-TIC was developed from MARISS for use by any caretaker in any set of circumstances.

The sheets labelled "STEP-BY-STEP WITH TAC-TIC", following Fig. VI.1 in section VI.2, comprise the material* of the TAC-TIC chart. This may be regarded as an instruction chart for use by anyone who is taking care of a new baby, but particularly parents.

VI.2 Early Results of TAC-TIC

The results of TAC-TIC confirm the results of MARISS. All physical measurements and neurological, motor and mental development assessments were blind. Only 15 subjects have been analysed so far, as follows:

VI.2.1 Before TAC-TIC treatment

The variables are:

(i) Birthweight (BW) and Gestation Age (GA);

(ii) Reflexes (sucking, rooting, palmar grasp, crawling, passive movements (arms and legs).

---

* At present in preliminary draft form only (September, 1983).

Table VI.1 shows the sample sistribution in respect of BW and GA by group. There is no significant difference between the two groups, hence it was accepted that both groups had been recruited from the same population.

Table VI.1 - Differences in Infants' variables (BW and GA) at birth, according to group.

Variables		Group	
		TAC-TIC (N=6)*	Non TAC-TIC (N=6)
1. Birth-Weight (kg.)	Mean	1.67	1.83
	S.D.	0.32	0.41
2. Gestation Age: (weeks)	Mean	32.0	33.3
	S.D.	2.7	0.5

1. not significant
2. not significant

* The triplets will be analysed separately in a special paper, not in this thesis.

Table VI.2 shows that the TAC-TIC group was poorer at birth than the control (non-TAC-TIC) group with regard to sucking, crawling, hand-grasp and arms and legs (passive movements). This result indicates that the latter infants at birth were at an advantage compared with the former group (TAC-TIC experimental group).

Table VI.2 - Differences in Infants' variables (Reflexes) at birth, according to group.

Variables		Group	
		TAC-TIC	Non TAC-TIC
1. Rooting	Mean	0	0
	S.D.	0	0
2. Sucking	Mean	0.8	1.5
	S.D.	0.8	1.0
3. Crawling	Mean	0.4	1.0
	S.D.	0.9	0.9
4. Hand grasp	Mean	0.4	2.0
	S.D.	0.6	0.9
5. Passive movements Arms	Mean	0.8	2.0
	S.D.	0.9	0.7
Legs	Mean	0.8	2.0
	S.D.	0.9	0.7

1. Not significant
2, 3, 4 and 5 significant at $p < 0.05$.

VI.2.2 During TAC-TIC treatment

Response to TAC-TIC was indicated by:-

(i) State

(ii) Stretching

(iii) Purring

The pattern of change of State was the same as shown in Fig. 5.7. Pictures VI.1, VI.2 and VI.3 illustrate well the pattern.

The infants also responded to TAC-TIC with stretching and purring (recorded on tape).

VI.2.3 After TAC-TIC treatment

2.3.1 Short term follow-up

The measurements were:-

(i) weight lost at week-1

(ii) reflexes at week-1

(iii) Dubowitz assessment at discharge

2.3.2 Long-term follow-up

The measurements were:

(iv) MDI at either 6 or at 12 months

(v) PDI at either 6 or at 12 months.

Picture VI.1

Picture VI.2 (a)

Picture VI.2 (b)

Picture VI.3

Table VI.3 shows the weight lost (see section 5.10), for both groups at week-1. TAC-TIC infants had a weight gain (mean) compared with a weight lost (mean) for non TAC-TIC infants. This result not only confirms the benefits of MARISS but appears to enhance them noticeably.

Table VI.3 - Differences in Infants' variables (weight lost) at week-1, according to group.

Group	Weight lost (-)/gain (+), gm.	
	Mean	S.D.
1. TAC-TIC (N=6)	+ 30.0	38.3
2. Non TAC-TIC (N=6)	- 82.5	45.7

Significant at $p < 0.05$.

Table VI.4 shows the results of reflexes (5.11) for TAC-TIC and non TAC-TIC infants. The differences between the two groups are not statistically significant. Apart from rooting and crawling, the other reflexes (sucking, hand grasp and passive movements) showed that TAC-TIC infants performed poorer than the non-TAC-TIC infants; this result is not surprising since Table VI.2 shows that the TAC-TIC infants were poorer at birth. Nevertheless the stimulation helped them to increase their performance. However it is surprising that non TAC-TIC infants, who performed better, did not improve their performance at the end of the week. Is this because they stayed "isolated" without stimulation? Moreover the TAC-TIC group, who started the poorer at birth, by the end of week-1 were attaining the same mean level of performance as those who had been better at birth. Of possible explanations, the most plausible is the beneficial effect of TAC-TIC; the result manifestly confirms the MARISS experimental figures (given in Chapter 5 of the thesis), in terms of physical development.

Table VI.4 - Differences in Infants' variables (Reflexes) at the end of week-1, according to group.

			Group	
			TAC-TIC	Non TAC-TIC
1. Rooting		Mean	0.4*	0
		S.D.	0.5	0
2. Sucking		Mean	1.2*	1.5
		S.D.	0.5	0.5
3. Crawling		Mean	1.2**	0.66
		S.D.	0.5	0.9
4. Hand grasp		Mean	1.0**	2.16
		S.D.	0.3	1.0
5. Passive movements				
	Arms	Mean	1.4*	2.00
		S.D.	0.5	0.4
	Legs	Mean	1.4*	2.00
		S.D.	0.5	0.4

* not significant
** significant at $p<0.05$.

Fig. VI.1 shows the results for the Neurological Assessment (Dubowitz) for both groups. The TAC-TIC group's mean Gestation Age (GA) when assessed was 36 weeks against a mean equivalent of 37 weeks for non TAC-TIC infants. Even younger TAC-TIC infants performed better than the non TAC-TIC group, thus again confirming MARISS results.

Table VI.5 shows the results for Bayley Mental and Motor Development at either 6-or at 12-months. Unfortunately for reasons quite beyond control, the 6 non TAC-TIC subjects who were not assessed at 6-months and were called for the 12-months assessment, only 3 responded.

From the last TAC-TIC sample (20 infants - 10 experimental and 10 control) only 9 (6 experimental and 3 control) had attained 6-months at the time of this assessment. Three of the six out of the experimental group, as triplets, are aberrant and are not being analysed at this stage.

Once again the stimulated (TAC-TIC) infants were shown to have better MDI and PDI than non TAC-TIC infants; although still behind the full-term infants in Mental (MDI) Development, they were not behind in Motor (PDI) Development.

In the author's view, TAC-TIC should be administered soon after birth and continuously, daily, for 3 months. Around the 3-months point, TAC-TIC should be substituted by a baby massage technique.

RACE | SEX | AGE | HEAD CIRC | GESTATIONAL ASSESSMENT | SCORE | WEEKS

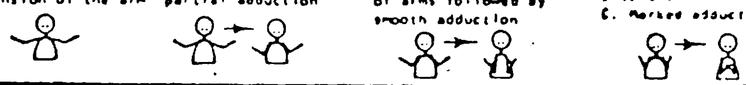
4 Awake, eyes open, minimal movement
5 Wide awake, vigorous movement
6 Crying

FIGURE : VI.1 ☒ TAC-TIC ☐ NON TAC-TIC

HABITUATION (≤ state 3)					
Light Repetitive flashlight stimuli (10) with 5 sec. gap. Shutdown = 2 consecutive negative responses	No response	A. Blink response to first stimulus B. Increasing response to repetitive stimuli C. Variable response	A. Shutdown of movement but blink persists 2-5 stimuli B. Complete shutdown 2-5 stimuli	A. Shutdown of movement but blink persists 6-10 stimuli B. Complete shutdown 6-10 stimuli	A. Equal response 10 stimuli B. Infant becomes ... state C. Startles + ... responses ...
Rattle Repetitive stimuli (10) with 5 sec gap	No response	Slight movement or blink to first stimulus	Startle or movement 2-5 stimuli, then shutdown	Startle or movement 6-10 stimuli, then shutdown	A B C } Grading as above
MOVEMENT & TONE	uncover infant				
Posture At rest - predominant			(hips abducted)	(hips adducted) $p < 0.05$	(opisthotonus)
undress infant					
Arm Recoil Infant supine. Take both hands, extend parallel to the body; release quickly	No flexion within 5 sec R L	Partial flexion at elbow > 100° within 4-5 sec. R L	Arms flex at elbow to < 100° within 2-3 sec. R L	Sudden jerky flexion at elbow immediately after release to < 60° R L	Difficult to extend; arm snaps back forcefully
Arm Traction Infant supine, head midline; grasp wrist, slowly pull arm to vertical. Angle of arm scored and resistance noted at moment infant is initially lifted off and watched until shoulder off mattress. Do other arm	Arm remains fully extended R L	Weak flexion maintained only momentarily R L	Arm flexed at elbow to 140° and maintained 5 sec. R L	Arm flexed at approx. 100° and maintained R L	Strong flexion arm < 100° and maintained R L
Leg Recoil First flex hips for 5 sec, then extend both legs of infant by traction on ankles; hold down on the bed for 2 sec. and suddenly release.	No flexion within 5 sec. R L	Incomplete flexion of hips within 5 sec. R L	Complete flexion within 5 sec R L	Instantaneous complete flexion R L	Legs cannot be extended; snap back forcefully R L
Leg Traction Infant supine. Grasp leg near ankle and slowly pull toward vertical until buttocks 2-3" off. Note resistance at knee and score angle. Do other leg.	No flexion R L	Partial flexion, rapidly lost R L	Knee flexion 140-160° and maintained R L	Knee flexion 100-140° and maintained R L $p < 0.05$	Strong resistance flexion < 100° R L
Popliteal angle Infant supine. Approximate knee and thigh to abdomen; extend leg by gentle pressure with index finger behind ankle.	180° R L	150° R L	110° R L	90° R L	< 90° R L
Head lag * Pull infant toward sitting posture by traction on both hands. Also note arm flexion					
Ventral suspension * Hold infant in ventral suspension; observe relation of trunk to head, curvature of back and flexion of limbs.					
Head control (post. neck musc) Grasp infant by his shoulder and raise him to sitting position; allow head to fall forward; wait 30 sec.	No attempt to raise head	Head raised with vigorous jerk	Unsuccessful attempt to raise head upright	Head raised smoothly to upright position within 30 sec.	Head cannot be flexed forward
Head control (ant. neck musc) Allow head to fall backward as you hold shoulders; wait 30 sec.	Grading as above	Grading as above	Grading as above	Grading as above	
Head raising in prone position Infant in prone position with head in midline.	No response	Rolls head to one side	Weak effort to raise head and turns raised head to one side	Infant lifts head, nose and chin off	Strong prolonged head lifting
Arm release in prone position Head in midline. Infant in prone position; arms extended alongside body with palms up.	No effort	Some effort and wriggling	Flexion effort but neither wrist brought to nipple level	One or both wrists brought at least to nipple level without excessive body movement	Strong body movement with both wrists brought to face or 'press-ups'
Body movement during examination (spontaneous). If no spont. movement try to elicit by cutaneous stim.	None or minimal	A. Sluggish and infrequent B. Random, inco-ordinated movements.	Smooth alternating movements of arms and legs with medium speed and intensity	Smooth movements alternating with some jerky or athetoid ones $p < 0.05$	A. Mainly jerky movement B. Athetoid movement
Abnormal movement or posture		A. Hands clenched but open intermittently. B. Hands do not open with Moro.	A. Some mouthing movement. B. Intermittent adducted thumb	Continuous mouthing movement	A. Continuously adducted thumb. B. Hands clenched all the time.
Tremors	No tremor	Tremors only in state 5-6	Tremors only in sleep or after Moro and startles	Some tremors in state 4	Tremulousness in all states
Startles	No startles	Startles to sudden noise, Moro, bang on table only	Occasional spontaneous startle	2-5 spontaneous startles	6+ spontaneous startles

REFLEXES — FIGURE: VI.1 (cont'd) ■ TAC-TIC □ NON TAC-TIC

Tendon reflexes Biceps Jerk Knee Jerk Ankle Jerk	Absent		Present	Exaggerated	Clonus
Palmar grasp Head in midline. Put index finger from ulnar side into hands & gently press palmar surface. Never touch dorsal side of hand.	Absent	A Asymmetrical B Short, weak flexion	[illegible] strength and [illegible] flexion) for several secs No spread of contraction to forearm	Strong flexion, contraction spreads to forearm	Very strong; infant easily lifts off couch
Rooting Infant supine, head midline. Touch corner of the mouth (mucosa); stroke laterally 3 times.	No response	A Partial weak head turn but no mouth opening. B. Mouth opening no head turn	Mouth opening on [illegible] side with [illegible] head turning	Mouth opening with full head turning $p < 0.05$	Mouth opening with very jerky head turning
Sucking Infant supine, place index finger (pad towards palate) in infant's mouth. Judge power of sucking movement after 5 sec.	No attempt	A Regular but weak sucking B. Irregular weak sucking movement	Commencement of sucking delayed but regular and strong when established	Strong regular sucking movement with continuing sequence of 5 movements.	A Infant clenches but sucks when [illegible] with finger B [illegible]
Walking Hold infant upright, feet touching bed, neck extended with finger.	Absent		Some effort but not continuous with both legs	At least 2 steps with both legs $p < 0.05$	A [illegible] movement. B. [illegible]
Moro One hand supports infant's head, the other the back. Raise infant to 45° and when infant is relaxed let his head fall through 10°.	No response	Full abduction at the shoulder and extension of the arm	Full abduction but only delayed or partial adduction	Partial abduction at shoulder and extension of arms followed by smooth adduction	A Moro jerky. B. No abduction, only extension C. Marked adduction only



NEUROBEHAVIOURAL ITEMS

EYE APPEARANCES	Sunset sign Nerve palsy	Transient nystagmus. Strabismus. Some roving eye movement.	Does not open eyes	Normal conjugate eye movement	A. Persistent nystagmus. B. Frequent roving movement C. Frequent rapid blinks.
AUDITORY ORIENTATION (state 3,4) To rattle	A. No reaction. B. Auditory startle but no true orientation.	Brightens and stills may turn toward stimuli with eyes closed	Alerting and shifting of eyes; head may or may not turn to source	Alerting; prolonged head turns to stimulus; search with eyes $p < 0.05$	Turning and alerting on both sides; sometimes accompanied by startle
VISUAL ORIENTATION (state 4) To red woollen ball	Does not focus or follow stimulus	Still focuses on stimulus; may follow 30° jerkily; does not find stimulus again spontaneously	Follows 30-60° horizontally; may lose stimulus but finds it again. Brief vertical glance	Follows with eyes and head horizontally and to some extent vertically, with frowning	Sustained fixation; follows vertically, horizontally, and in circle
ALERTNESS (state 4)	Inattentive; rarely or never responds to direct stimulation	When alert, periods rather brief; rather variable response to orientation	When alert, alertness moderately sustained may use stimulus to come to alert state	Sustained alertness; orientation frequent and reliable to visual but not auditory $p < 0.05$	Continuous alertness, which does not seem to tire, to both auditory and visual
PEAK OF EXCITEMENT	Low level arousal to all stimuli; never > state 3	Infant reaches state 4-5 briefly but predominantly in lower states	Infant reaches state 6 after stimulation but returns spontaneously to lower state	Infant reaches state 6 but can be consoled relatively easily	A. Difficult to console, if at all. B. Stays in state 4-5 with all stimulations but if reaches state 6 cannot be consoled.
IRRITABILITY (states 3,4,5) Aversive stimuli: Uncover, Undress, Pull to sit, Prone, Ventral susp., Moro, Walking reflex	No irritable crying to any of the stimuli	Cries to 1-2 stimuli	Cries to 3-4 stimuli	Cries to 5-6 stimuli $p < 0.05$	Cries to all stimuli
CONSOLABILITY (state 6)	Never above state 3 during examination, therefore not needed	Consoling not needed. Consoles spontaneously	Consoled by talking, hand on belly or wrapping up	Consoled by picking up and holding; may need finger in mouth	Not consolable
CRY	No cry at all	Only whimpering cry	Cries to stimuli but normal pitch	Lusty cry to offensive stimuli; normal pitch	High-pitched cry, often continuous

NOTES * If asymmetrical or atypical, draw in on nearest figure

Record any abnormal signs (e.g. facial palsy, contractures, etc.). Draw if possible.

Record time after feed:

Examiner:

Table VI.5 - Differences in Infants' variables (MDI and PDI) at either 6- or 12-months (mean), by group.

Variables		Group			
		TAC-TIC	N	Non TAC-TIC	N
1. MDI (6-months)	Mean	118.0*	3	107.3	3
	S.D.	13.4		35.0	
2. PDI (6-months)	Mean	128.0**	3	117.3	3
	S.D.	20.0		33.0	
3. MDI (12-months)	Mean	-		127.3	3
	S.D.	-		9.6	
4. PDI (12-months)	Mean	-		99.0	3
	S.D.	-		13.3	
5. MDI (Full-Term, 6-months)	Mean	-		136.0	2
	S.D.	-		27.2	
6. (Full-Term, 6-months)	Mean	-		116.0	2
	S.D.	-		18.4	

* Significant at $p < 0.05$.

** Significant at $p < 0.05$.

Appendix VI (a)

Table VI (a) 1 shows the weight gain (see section 5.14), for both groups at week-3. Treated infants had greater weight gain than untreated infants. This result confirms the result of the main study.

Table VI (a) 1: Differences in Infants' variables (weight gain) at week-3, according to group.

Group	Weight gain (gm) (day-21 less BW) Mean	S.D.
1. TAC-TIC (N = 6)	360	108.2
2. Non-TAC-TIC (N = 6)	275	111.8

significant at $p < 0.05$

Table VI (a) 2 shows the results of reflexes (see section 5.14.2), for treated and untreated infants. The results shows that treated infants performed better in sucking and hand grasp ($p < 0.05$), thus confirming partially the results of the main study.

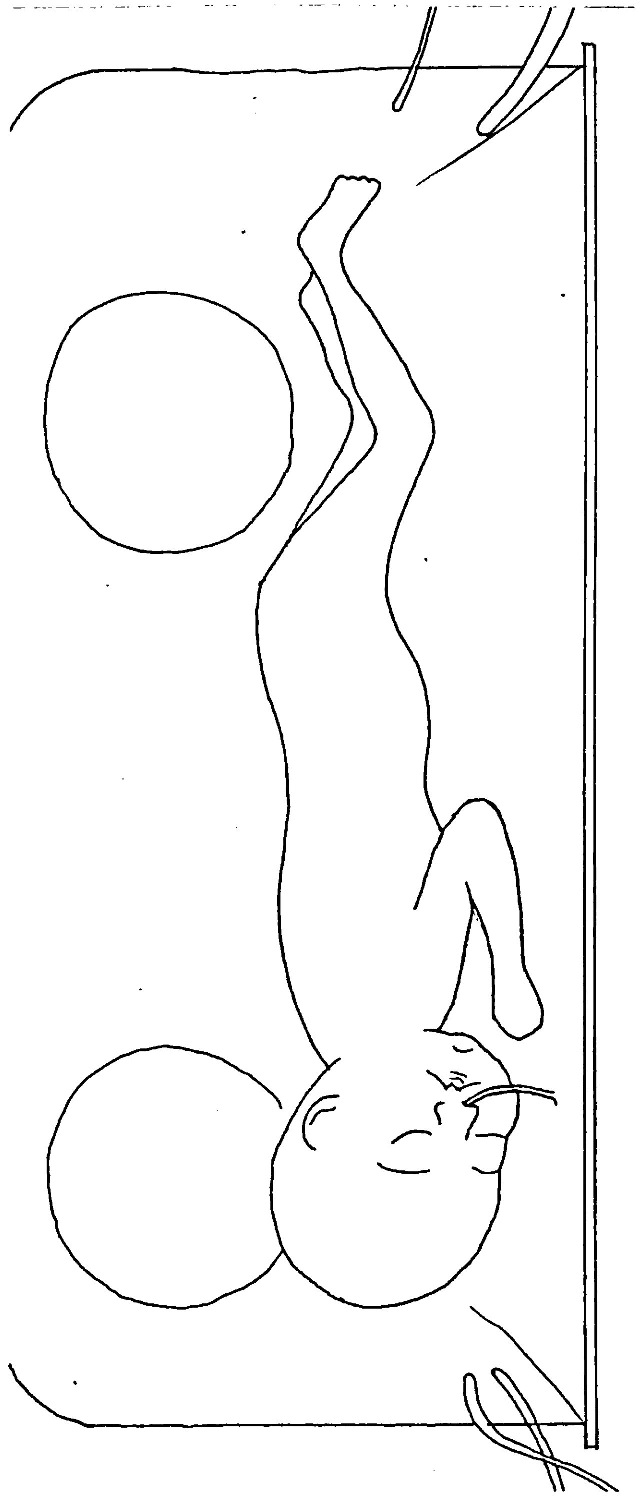
Table VI (a) 2: Differences in Infants' variables (Reflexes) at the end of week-3, according to group.

Group	Reflexes 1.Rooting	2. Sucking	3.Crawling	4.Hand Grasp	5.Passive movements legs	arms
1. TAC-TIC (N = 6)	0.6 (0.5)*	2.0 (0)	1.7 (0.5)	1.9 (0.4)	1.8 (0.4)	1.8 (0.4)
2. Non-TAC-TIC (N = 6)	0.5 (0.4)	1.2 (0.5)	1.3 (0.9)	1.0 (0.6)	2.0 (0)	2.0 (0)

* Standard deviation.

Touching And Caressing ~ Tender In Caring.

TAC ~ TIC.



Baby in Initial, Prone Position.

STEP-BY-STEP WITH TAC-TIC

1. Preliminary Stage

1.1 Wash your hands carefully. Use Hibisol if your baby is premature and is at the SCBU. Do NOT be in a hurry. It is time for YOU and YOUR baby. Be confident. This baby is yours. He/she is not going to break. He/she needs the care of the doctors and the nurses BUT he/she also needs YOUR Touching And Caressing - Tender in Caring (TAC-TIC).

1.2 Warm your hands, rubbing one against the other. Whilst you do this:-

1.3 Watch your baby's position,

and 1.4 Open the two windows of your baby's "glass house" (incubator), or just approach his/her cot. You are both ready for each other.

2. Stages of TAC-TIC

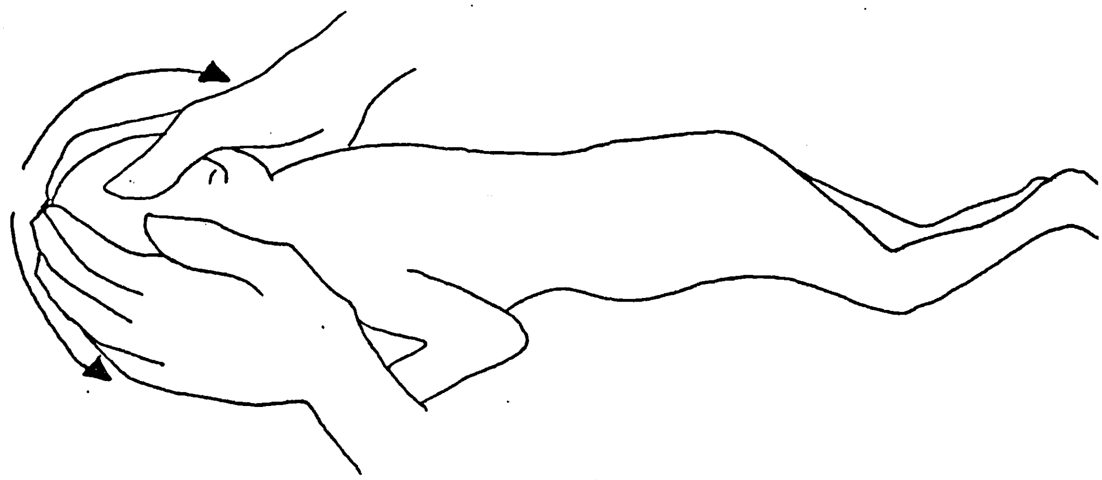
You will find 34 instructions** on the pages to follow. They are the movements of your fingers, palms and hands which you will use to help your baby.

There is also a sketch of a baby's foot. As shown, it is the left-foot, as seen from the top; it is also the right-foot, but seen from underneath, from the sole. The text is written in terms of the left-foot; when you come to instruction 2.15, simply apply instructions 2.8 to 2.14 to the right-foot. You will easily master the technique when you have carefully done it once.

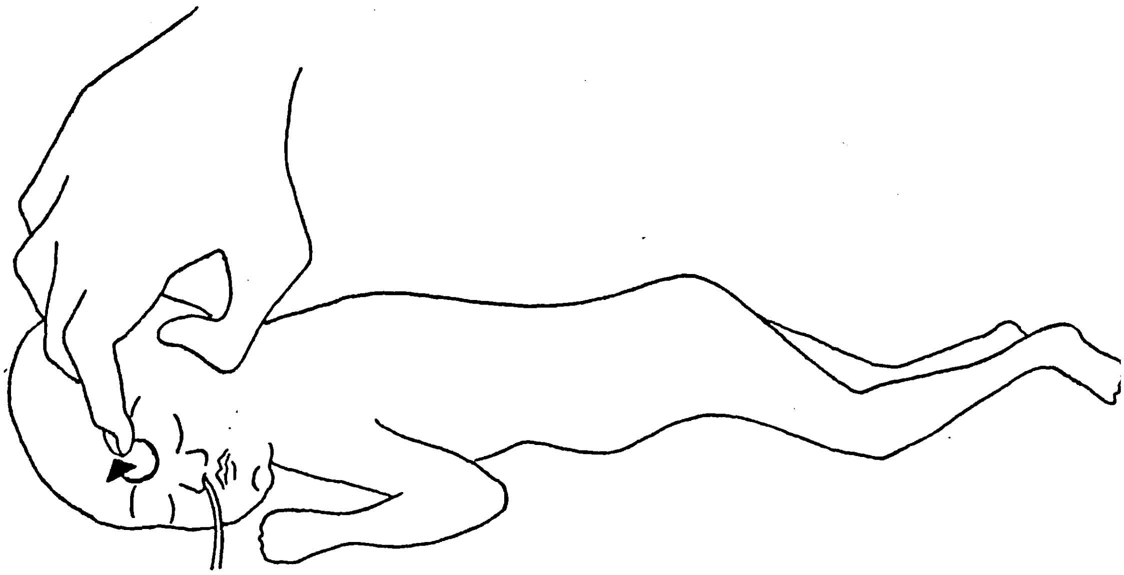
Some instructions have remarks in parenthesis and indicated with an *. These indicate old systems of "pressure-point" stimulation. Do not forget that you are stimulating your baby's bodily functions, and so helping him/her to develop.

** The material of the chart is in draft form only; the drawings are not complete and the correlating text requires final assembly and editing.
It is presented here to indicate the style which is being adopted.

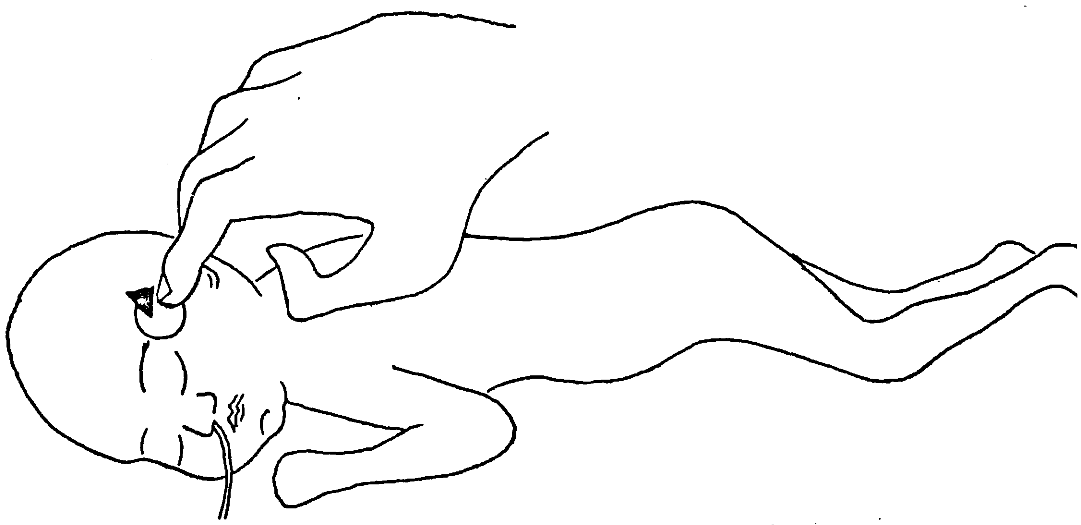
2.1 Using both of your hands, cover your baby's head from the middle crown towards the forehead with your left hand, and from the middle crown towards his neck with your right hand. Repeat this movement from three to six times, as you like. Watch your baby's response. He/she may respond by blinking the eyes, opening the eyes, moving his/her head or arms or legs, moving his/her mouth, breathing deeper, or in some other way. Each baby is an individual. Your baby may respond differently from other babies. It is his/her response. TAC-TIC is a good way for you to start to GET-TO-KNOW your baby and attend to his/her PARTICULAR NEEDS.



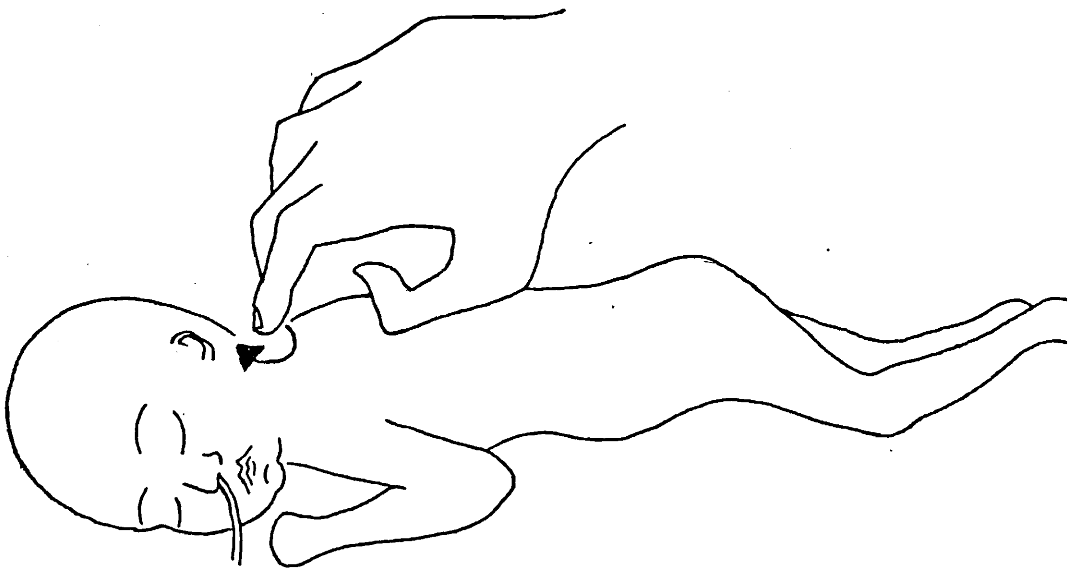
2.2 Using one of your fingers in circular movements between the eyebrows, caress the middle of your baby's forehead.



2.3 Do the same as 2.2, but on the temples.

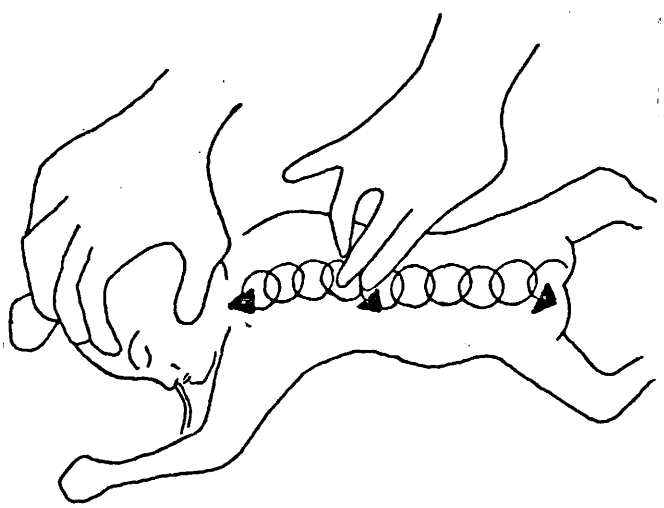


2.4 Do the same as 2.2, and 2.3, but on the nape of the neck, at the top of the spine.

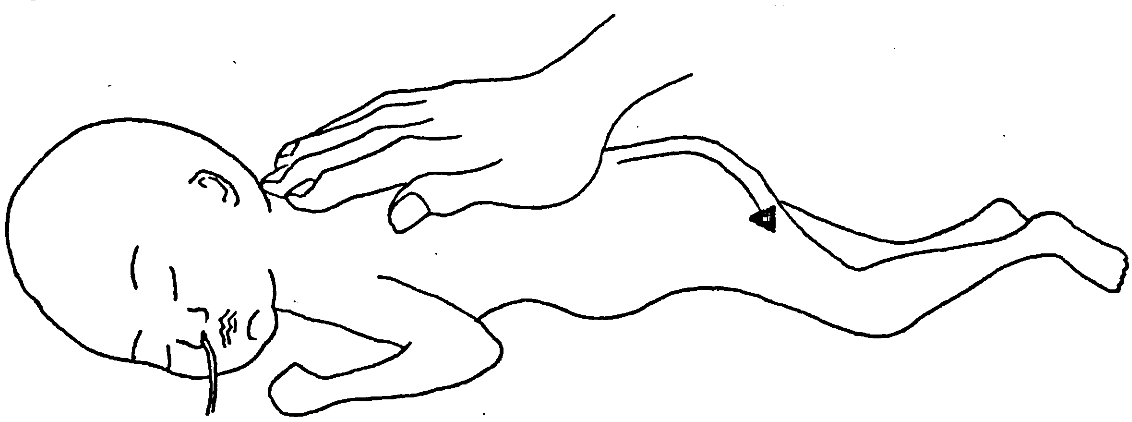


2.5 Is your baby on his tummy? With the second fingers, of both hands, placing each one in each side of the body, make sideways and downwards movements towards the spine; do this three to six times using gentle but firm touching. Use your finger ends, YOUR TENDER TACTORS. Watch your baby's response. Press and make circular movements.

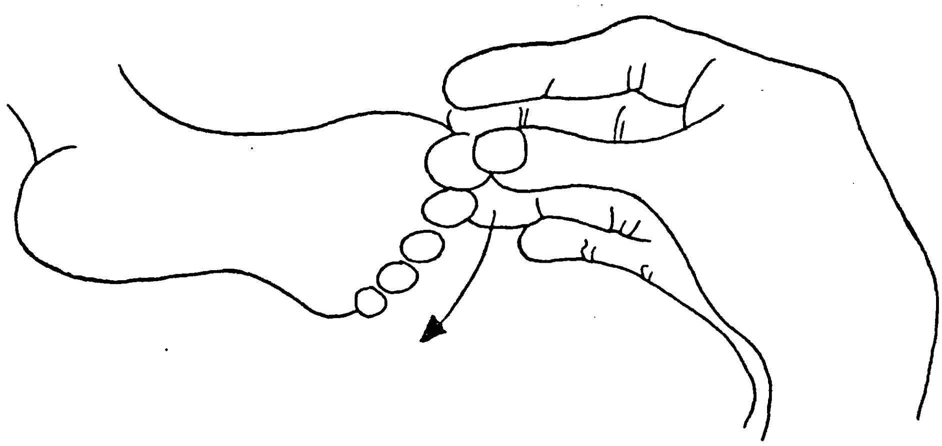
2.6 With one of your tender tactors make circular movements, feeling each link of the vertebrae all the way down the spine, from neck to bottom. From bottom to neck, make the movements continuously and slowly, thinking how much you love your baby, how much you need each other but how much he/she needs to know that he/she is important, that he/she is loved and that YOU ARE THERE. Only by YOUR touching, by the smell of YOUR skin can he know that YOU ARE THERE since he/she is otherwise isolated in the incubator. Do you know how awful it is to be isolated in the incubator, being touched only to be given unpleasant stimuli, such as obtaining a blood sample, or an X-ray. The babies cannot express themselves, but may well feel, "Where is love in this world?" "Where is my Mummy or my Daddy?"

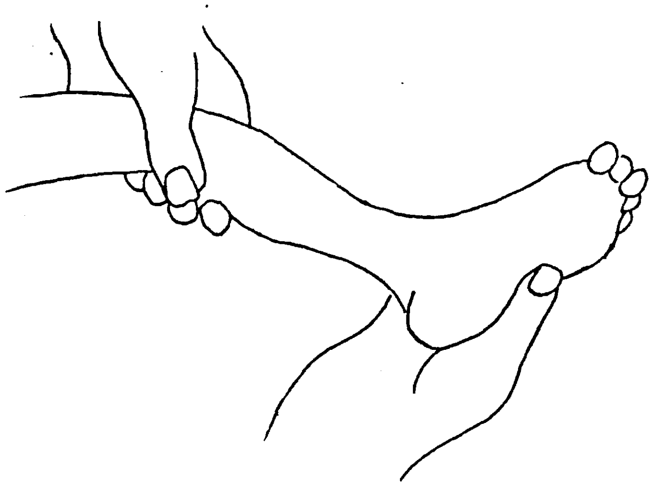


2.7 Cover his/her body (back) with your hand from the nape of the neck and stroke towards the bottom. Gently now. Do not pull the skin. Very gently now, with firm, "butterfly" touching. Touching tenderly, warming his/her back with the palm of your hand. Repeat this 3 to 6 times.

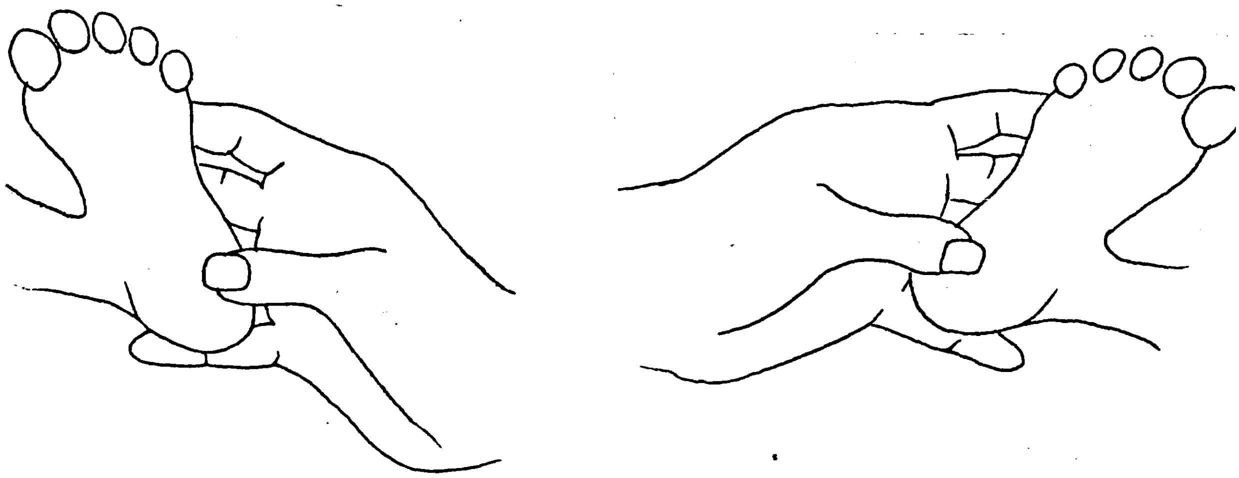


2.8 Hold his/her left foot gently. Very, very gently lift his/her leg a little from the mattress, and with your hand stroke from the upper leg to the foot and toes, Open the toes. Relax them, and gently extend them one by one, very, very gently. Then press, for about 10 seconds, the sole of the foot gently, right in the middle towards the inner part of the foot (see B of the "Foot diagram"). By doing this, you may be stimulating your baby's spine.*



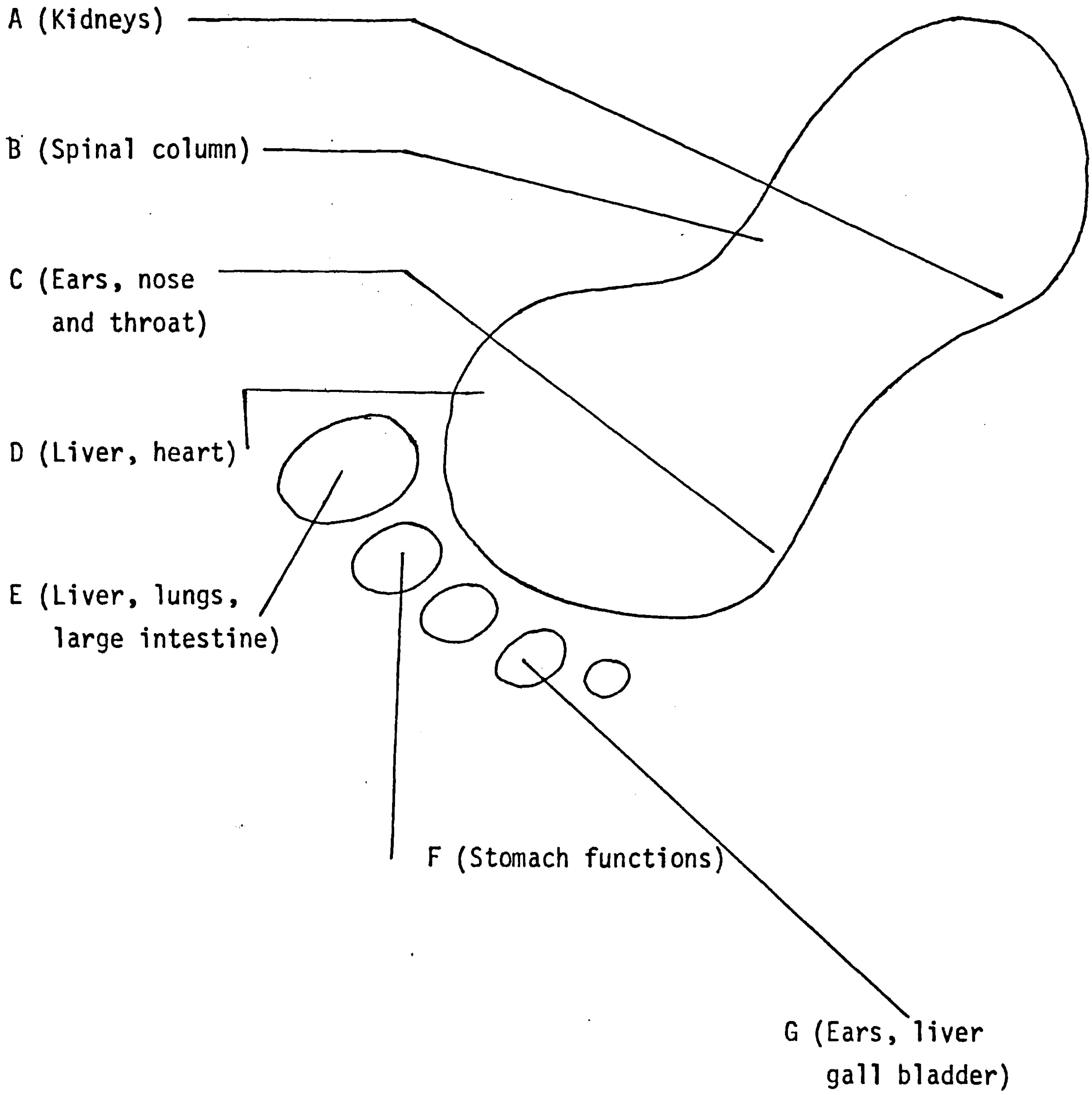


2.9 Then press gently the outer, rear side (near to the heel) of the left foot, at point A of the "Foot diagram", for 10 seconds, or so (by doing this, you may stimulate his/her kidney functions).*

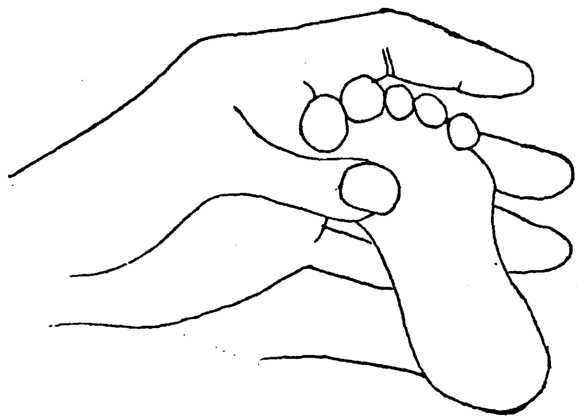


2.10 Then press gently the outer, front side (on the line of the heel of the foot) at point C of the left foot (by doing this you may stimulate his/her ear, nose and throat functions)*.

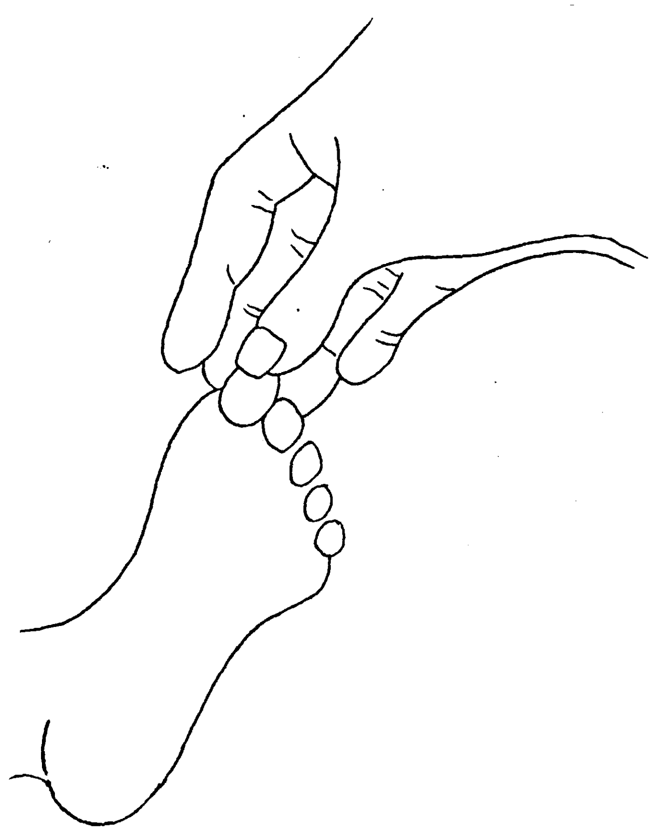
GUIDE TO THE INFLUENCES OF THE PRESSURE-POINTS OF YOUR BABY'S FEET



2.11 Then press gently the ball of the left foot of your baby for 10 seconds (by doing this, you may stimulate his/her liver and heart functions).*



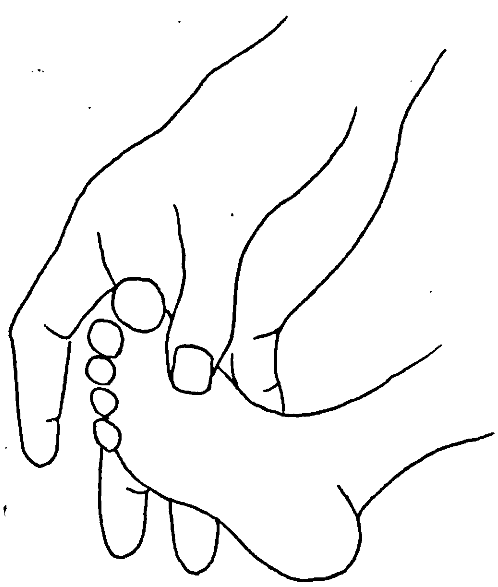
2.12 Then press gently for ten seconds, the big toe of his/her left foot (by doing this you may be stimulating his/her liver, large intestine functions and lungs).*



2.13 Then press gently his/her second toe of the same foot (you may be stimulating his/her stomach functions).*

2.14 Then press gently his/her fourth toe, next to the little toe, of the left foot (you may well be stimulating his ear, liver and gall bladder functions).*
Repeat 2.8, to 2.14, inclusive, for 3 to 6 times, but always in the same sequence. Always be thinking or telling your baby how much you love him/her.

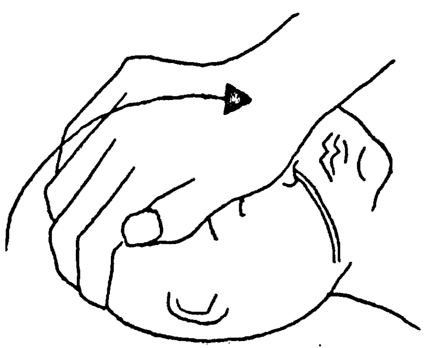
2.15 Repeat each of the previous instructions 2.8, to 2.14, inclusive, in sequence to the other (right) foot; try to give a "feeling" of "total continuity", then.......,

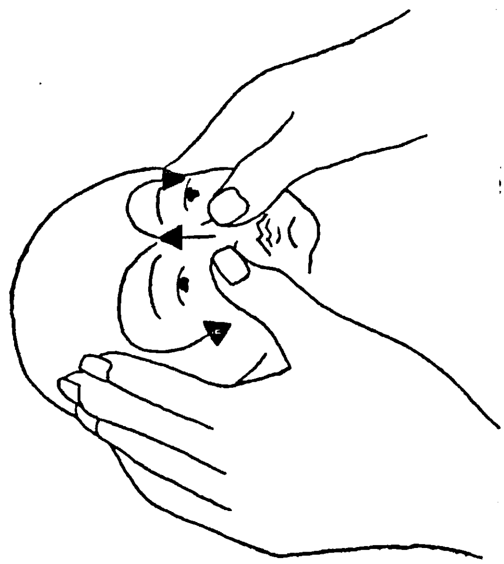


2.16 Turn your baby over; carefully and gently watch his/her response. He/she may blink, move mouth or twitch the nose, open the eyes, stretch, purr, etc. Become attuned to his/her response and his/her needs. Your baby will certainly give you some sort of "clue".

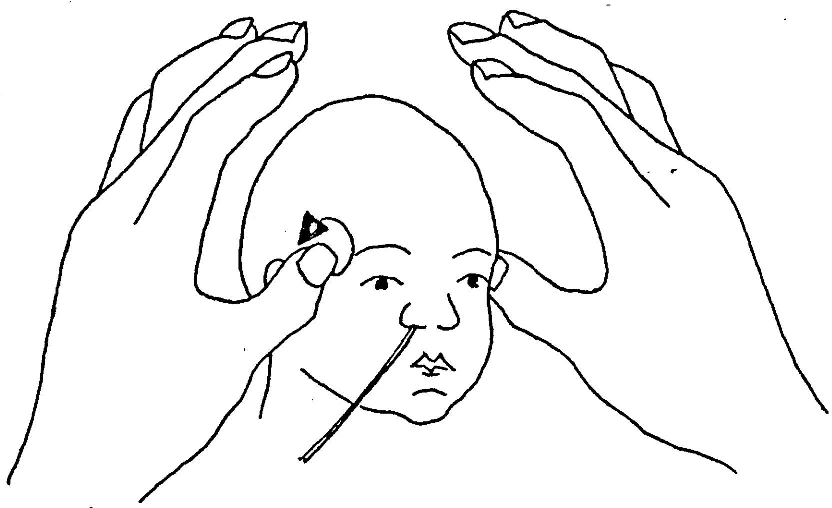
It does not matter if you do not talk, but to "think about your baby" is vital. Warm your hands as necessary. Place your tender tactors on the top (middle crown) of his/her head; touch his/her head with your palm, and stroke towards the forehead. Repeat this 3 to 6 times.

2.17 Put one of your hands on the top of your baby's head, and stroke down to the forehead and down to his/her nose. Place both of your thumbs on his/her nose, and stroke up to the forehead in the direction down towards the chin. Repeat this 3 to 6 times.

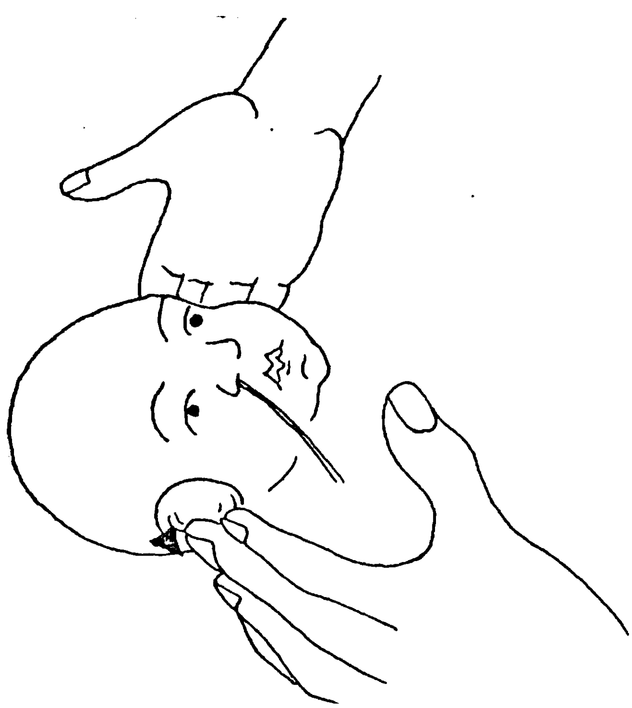




2.18 Put each of your thumbs on your baby's temples, and stroke each of these areas with a circular movement. Repeat 2.3



2.19 Stroke the surface of your baby's ears, following the shape of the ear up, around and down to the ear lobe. Repeat this 3 to 6 times, always using your second (index) fingers.



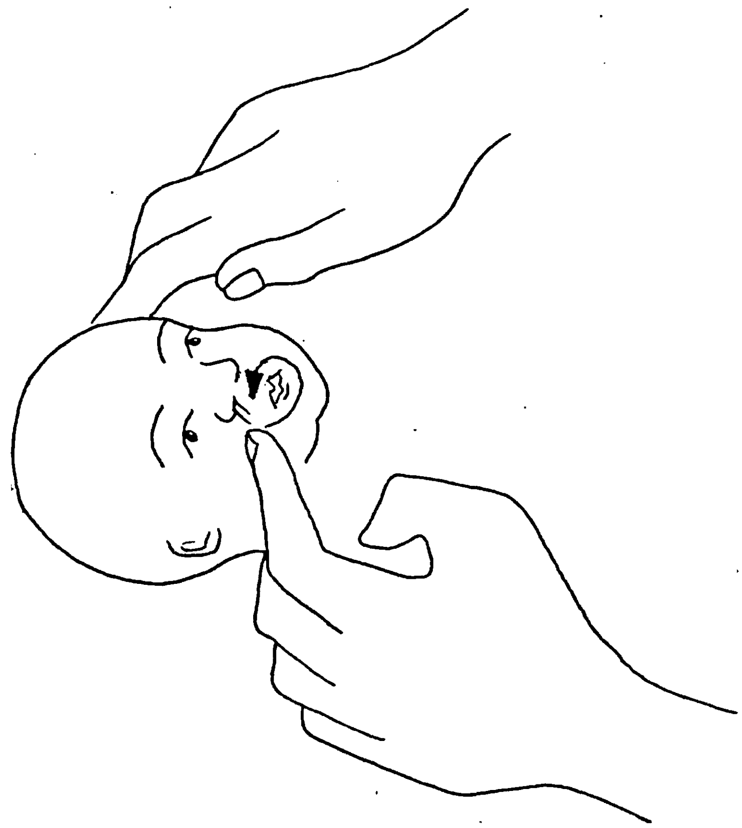
2.20 Place your second (index) fingers on each side of his/her neck, JUST at the nape of the neck but at the side of the spinal column, and circularly stroke this part gently. Watch his/her response. Encourage your baby by thinking or telling him/her how beautiful he/she is, and how lovely it is to touch him/her. Repeat this 3 to 6 times. Watch his/her responses.

2.21 With the tender tactors (pads) of your thumbs, stroke gently around his/her eyes. Support his/her head with your hands. From the corner of the eyes stroke down towards the sides, across below the eyes, and return gently up to the corners. Repeat this 3 to 6 times.

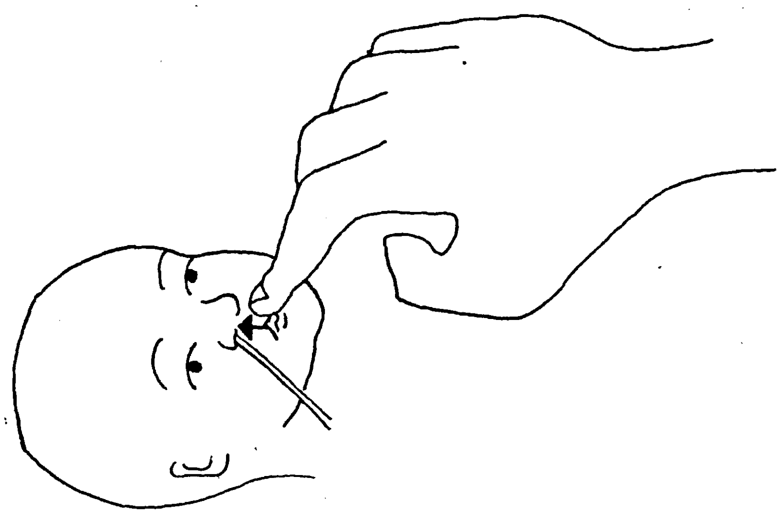
2.22 Also with your index finger, make circular movements on the middle of your baby's forehead. Repeat this 3 to 6 times. Repeat 2.2

2.23 Move your thumbs from the sides of the nose towards his/her cheek and towards the ears. Repeat this 3 to 6 times.

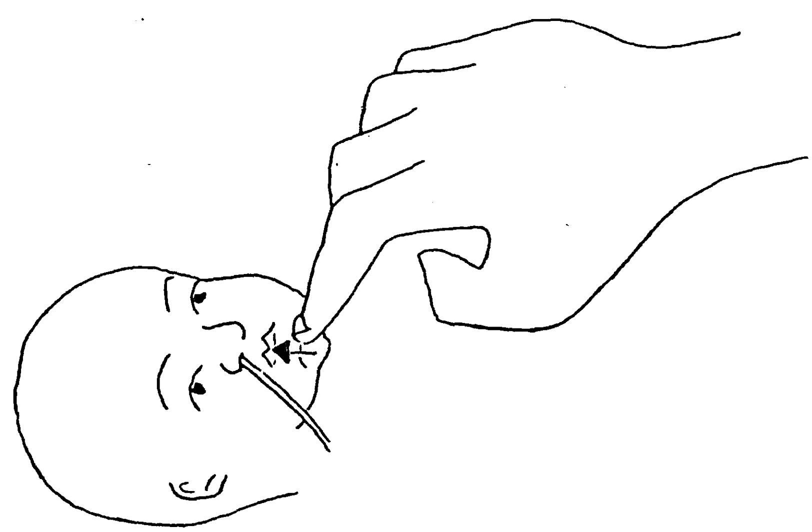
2.24 With your second (index) finger stroke around your baby's mouth. Watch his/her response. This movement may provoke a nice "mimic" gesture and "rhythmic" reaction of his/her mouth. This movement is very important in order to stimulate SUCKING. Look at him/her to determine the importance of sucking performance, especially if your baby is premature.



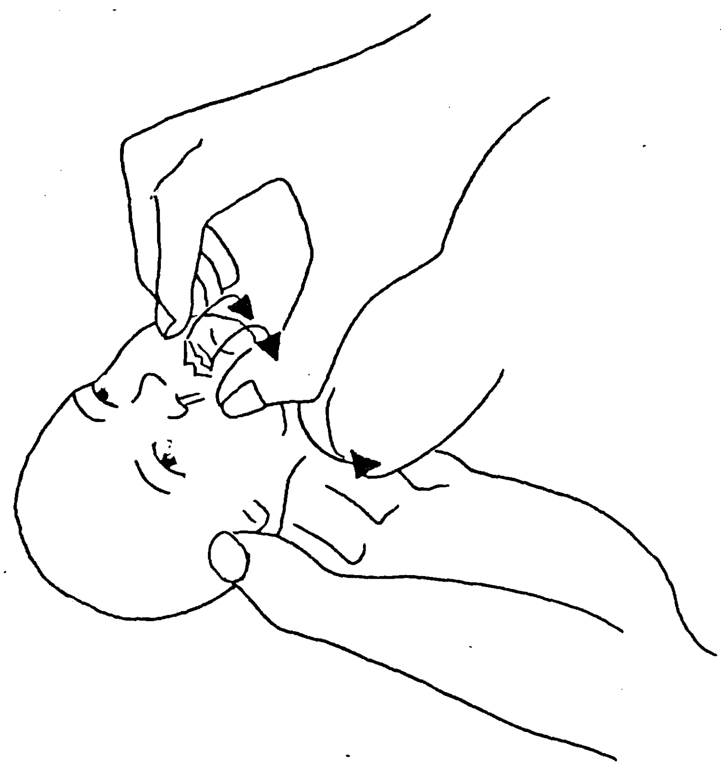
2.25 Touch gently on the middle top of the lip of his/her mouth with one of your fingers; moving your finger tip slowly towards his/her nose, watch his/her response. Repeat this 3 to 6 times.



2.26 With one of your fingers, touch gently the middle of his/her bottom lip, and move your finger in turn towards each cheek. Repeat this 3 to 6 times. This movement, as well as movements 2.24 and 2.25 are significant for stimulating sucking.

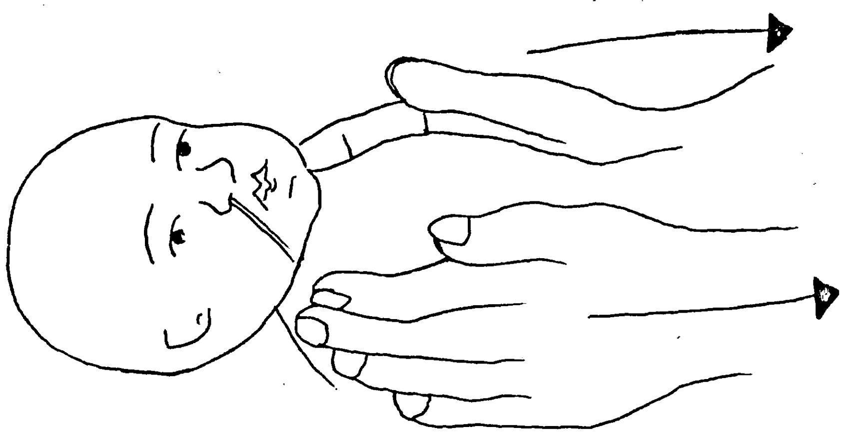


2.27 Tilt back your baby's head (supporting the shoulder, neck and head with one of your hands), and with the tender tactors of your thumb stroke gently from the middle of your baby's chin towards the throat, and from both sides of his/her chin towards the throat. Repeat this 3 to 6 times.



2.28 Cover your baby's body with one or two hands (according to the size of your baby) and stroke from the throat towards his/her genitalia. His/her sphincter muscles will relax, and hence your baby may urinate. If your baby is on your lap have a nappy handy. Repeat this 3 to 6 times.

2.29 Place each of your hands underneath his/her arms, and stroke from there towards his/her legs. Repeat this 3 to 6 times. Watch your baby's response.



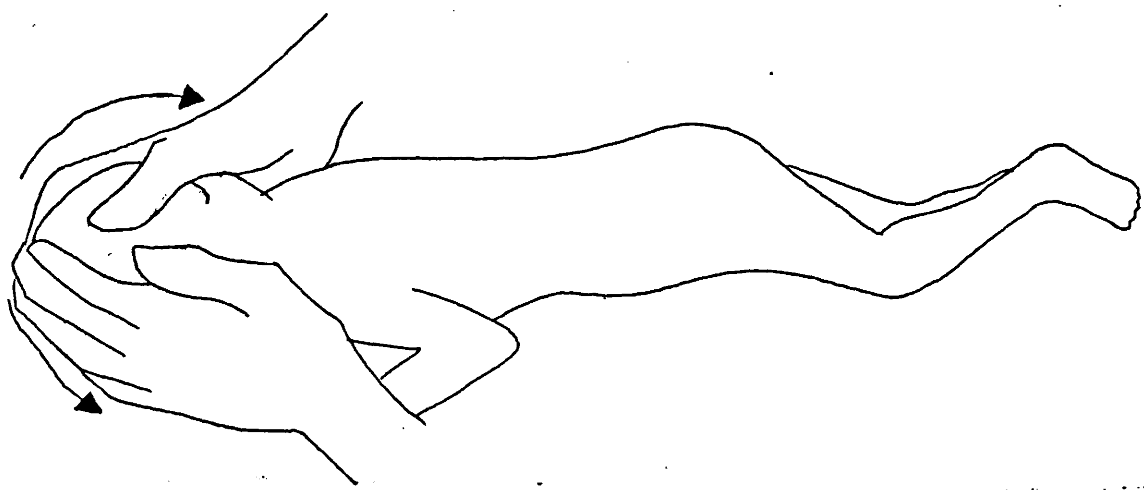
2.30 Hold his/her hand with one of your hands, and with your other hand stroke from the shoulder down the arm towards his/her hand. Repeat this 3 to 6 times. Watch your baby's response.

2.31 Do the same relaxing (balancing) movement with each of his/her fingers, as with the toes, described in item 2.8 above. Press gently in between the thumb and the index finger (this may be useful to stimulate the spinal column*). Bring his/her right-hand gently to touch his/her left hand, and vice-versa. Repeat this 3 to 6 times. Do the other arm in the same way.

2.32 With your index and middle finger stroke, with vibrating movements, along the "middle line" of your baby from the throat towards the genitalia. Repeat this 3 to six times. Watch your baby's responses.

2.33 Hold his/her foot with one hand and with the other stroke from the upper leg towards the foot. These are the same movements as in item 2.8 above. Do the other leg. Also, make sure, as in 2.8 above, that you gently relax and extend the toes.

2.34 Repeat all the movements from 2.16,to 2.33, inclusive, more to give your baby a feeling of continuity. Your baby is very important; encourage him/her to thrive with the gentle movements described above and in the drawings.



When you have completed the above put your baby in the initial position.

Appendix VII

Type of 'milk intake' at day-7 for hospitals -2 and -3 separately.

Type of milk	Hospital -2		Hospital -3	
	Intervention	Non-Intervention	Intervention	Non-Intervention
Expressed Breast milk (EBM)	4	5	13	14
Osterfeed + EBM	-	-	-	2
Osterfeed only	-	-	2	1
SMA + EBM	1	1	-	-
SMA only	1	1	-	-
Total	6	7	15 *	17 **

* 4 missing values

** 5 missing values

Appendix VIII

Chi-Square tables for 'Characteristics of parents of the low-birth-weight infants'.

Hospital -1

Race (father)

Group

Race	1	2	
1	4	6	10
2	2	0	2
	6	6	12

X^2 = 2.4 df 1
not significant

Race (mother)

Group

Race	1	2	
1	4	6	10
2	2	0	2
	6	6	12

X^2 = 2.4 df 1
not significant

Hospitals -2 and -3

Group

Race	1	2	
1	13	17	30
2	12	11	23
	25	28	53*

* one is missing value
X^2 = 0.408 df 1
not significant

Group

Race	1	2	
1	15	18	33
2	10	11	21
	25	29	54

X^2 = 0.02 df 1
not significant

Appendix VIII (Continued).

Hospital -1

Occupation (father)

Occupation	Group 1*	Group 2	
2	2	3	5
3	2	2	4
4	0	1	1
	4	6	10

$X^2 = 0.83$ df 2

not significant

* two schoolboys.

Occupation (mother)

Occupation	Group 1*	Group 2**	
2	1	1	2
3	2	3	5
4	0	1	1
	3	5	8

$X^2 = 0.746$ df 2

not significant

* one schoolgirl, two house wives

** one house wife

Hospitals -2 and -3

Occupation	Group 1	Group 2	
2	9	5	14
3	14	18	32
4	2	4	6
	25	27	52

$X^2 = 2.235$ df 2

not significant

Occupation	Group 1*	Group 2**	
2	1	3	4
3	16	12	28
4	3	2	5
	20	17	37

$X^2 = 1.54$ df 2

not significant

* three house wives

** eleven house wives and five missing values

Appendix IX

Dear Mrs

We are trying hard all the time to find ways to improve the care of premature infants. We are particularly interested in the amount of stimulation they receive. Babies born at the right time get a great deal of stimulation in the form of cuddling and stroking by their mothers. This is not possible to the same extent with a premature baby who needs to be in an incubator. However, we do believe that premature babies may benefit from receiving extra stimulation, and that it could help to develop their nervous system and the way they respond to their parents. It is difficult to prove that this is so, and needs a carefully designed investigation. We are carrying out such an investigation here, and hope you will agree to take part. It involves stroking your baby's skin, according to a definite plan, for 10/15 minutes twice daily. This stroking will be carried out at first by Didi Macedo and later, after you have been shown the method, by you.

In order to find out whether the stimulation is having a beneficial effect, we should like to follow up your baby during the first 3 months to see how well he/she is thriving and to test the progress of his/her development. This can be arranged to coincide with a regular clinic visit at the hospital.