INVESTIGATION OF INDIVIDUAL DIFFERENCES IN NEWBORN INFANTS

by

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ABSTRACT

The purpose of the study was to investigate the first manifestations of variation in human beings. The objective was to describe differences that first appear and to clarify some of the dimensions and limits which form the background of such variations.

Thirty-nine neonates, all of whom, according to medical opinion, were normal, were used as subjects. Each child was observed for eight 30-minute periods while lying in his cot, and two or three times whilst being fed by his mother. These observation periods were spaced throughout the first, third, and fifth days of life and were planned to take account of the infant's age and feeding cycles. All recording was done in code by the same observer.

The following analyses were carried out on cotside data and results were as described: Three states of infant behaviour which were named 'sleep', 'specific activity', and 'mass activity' were differentiated in terms of the amount and type of movements that infants showed, and individuals were compared to see whether consistent dispositions toward either sleep or mass activity could be found. No such consistency was found.

Individuals were compared to see whether or not some babies were consistently more active during sleep or mass activity

than others. Results of this analysis were ambiguous.

Head, facial, body, limb and extremity movements were totalled for each infant each day and results were compared to see whether infants differed in the sequences they showed. Results indicated that there were no established sequences during the first week.

Mass activity was analyzed and seven differently structured patterns were found. Most of these became more frequent as the child grew older, and there were some differences in the patterns shown by different babies.

Data from feeding observations enabled a comparison to be made between the feeding situations of bottle and breast fed infants. As a result it was found that breast fed infants experience a wider variety of maternal emotions, tend to be less skillfully handled and to show more signs of frustration. There was no significant difference between the two types of feeding group in proneness to sleep or mass activity.

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INVESTIGATION OF INDIVIDUAL DIFFERENCES IN NEWBORN INFANTS

Chapter I

INTRODUCTION

Few would deny that no two persons are quite alike. Most agree that human adults differ in personality and temperament, and that even young children show distinctively individual patterns of behaviour. Speculation about such differences and the reasons for them has been plentiful, resulting in a multitude of explanations, hypotheses, and theories. These, however, leave the exact origins of differences in human behaviour, personality, and temperament still unknown, and their history still uncharted. Indeed, the genesis and development of personality and other human differences remains obscure.

If this fog surrounding present understanding of personality and other human differences is to be dissolved, it is necessary first that their beginning manifestations be identified; that is, that we locate the earliest time period in the human life span when such differences can be recognized, and that we clarify the exact forms in which they appear then. The present study is directed towards this purpose, and in so being, it undertakes to investigate the spontaneous activities of human infants during the first week of neonatal life.

The primary objective is to describe the range of observable behaviour that occurs during this period and to signify those areas or dimensions of activity in which distinctive differences between neonates may appear.

With the type of purpose described above, neonates appear to be particularly suitable subjects for study because many different groups have suggested that differences may be apparent even at this early stage of life. Though unable to describe explicitly the nature of what they have seen, or the basis on which they have formed their opinions, mothers, nurses, physicians, and others who are in frequent contact with the very young, state repeatedly and definitely that infants differ considerably even during the first days of post-natal life. These judgments, which are based on casual and clinical observation, are supported to some extent by a variety of controlled studies of human neonates.[1] For example, though concerned with the investigation of infant behaviour, rather than with individual differences, Aldrich, Sung and Knop (1945) drew attention to differences in the crying patterns of infants, and Irwin (1930, 1932a, 1932b) found variations in the amount of motility that neonates displayed. The fact that differences exist in newborn infants, therefore, seems to be indicated by definite, though often inexact evidence from many sources.

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1 These will be reviewed more fully in Chapter II.

Types of difference that are described are as heterogeneous as the sources that testify to their existence. On the one hand there are obvious physical variations in size, colouring and hair growth which are evident to the most casual observer. On the other hand there are more obscure differences such as in sensitivity to particular forms of stimulation, or in effectiveness of reflex mechanisms. In addition, differences in the spontaneous behaviour of young infants are implied when mothers, nurses, or professional persons describe a child as always having been 'very active', 'very nervous', 'very loving' or 'very intelligent.' The basis for these descriptions is seldom revealed.

Whatever the nature of the differences being cited, it is assumed that there is some modal value against which the person making the judgment is matching the infant that he describes. In the case of physical variations, these modes are relatively easy to determine. When, for instance, a neonate is described as being 'large' or 'small', it is known that the normally expected birth weight range of six to seven pounds is being used as the standard of comparison. Similar commonly held, though less precise standards are being invoked when his hair is said to be 'long' or 'short', 'fair' or 'dark'. When, however, non-physical factors have to be considered, it is much harder to formulate an accurate description of an infant. Adjectives such as 'active' and 'nervous' have no meaning unless there is some generally understood level of expected activity or equanimity from which a particular baby could be said to deviate. At the present time, no such standards have been defined. Infant behaviour is evaluated

for the most part in terms of the subjective, idiosyncratic concepts of the person making the judgment.

The second objective of this study therefore will be to describe forms of behaviour which are to be expected in normal neonates. It is only when normally manifested types of activity have been described and the limits of their usual occurrence have been set that the confusion which results from individual frames of reference can be avoided and the uniqueness of individuals can be properly appreciated. Babies will differ only if they exhibit traits and activities that are not manifested by their peers, or when they possess common attributes to a greater or lesser degree than others of their own age. These factors cannot be assumed unless characteristics which are generally expected in neonates have been described.

Much work has been done on the types of stimuli that affect neonates, and infantile reflex equipment and capacities for sensory response have been fairly well explored. By comparison activities performed spontaneously by infants during the natural course of their daily lives has been rather neglected in recent research. It is realized that newborn babies cry, feed, urinate, defecate, sleep, wake and move about in their cots, but little time has been devoted to study of such activities. They are often inadequately described in psychological literature, and details of how they are carried out or the circumstances in which they are likely to occur are frequently lacking. Which behavioural sequences are common to numbers of infants, and which are

stable and typical in individuals only are also not known. Results of the present study should help fill some of the gaps in our knowledge about neonates. In so doing, they may also reveal some of the areas of neonate behaviour and characteristics in which the origins and cues to later personality differences lie, though it will be left for other researchers to follow up and confirm whether such is the case.

If differences are apparent at such an early age, they probably take the form of variations in basic constitution and are manifested through physical behaviour and levels of motility. Some infants may thus react more extensively than others to internal and external stimuli; some may show more, some less general bodily movement. Different patterns of physical activity may be observable, and qualitative differences may be apparent in patterns that are common to all babies.

Better description of normally occurring activities and knowledge of some of the ways in which infants might be expected to differ at birth could have many practical advantages. Not only would psychological theory be advanced and our understanding of personality increased, but conditions of disease and deficiency, which are at present unnoticeable until the destructive process has reached a point where the damage done is irreversible, might be diagnosed in their early stages. In addition, some of the injuries which occur during delivery but do not become apparent until months or even years after birth, might be noticed during the first days of life.

With all these considerations in mind, thirty-nine infants, all of whose potential for development was considered to be normal, were studied. They were observed during their first week of life, and recordings were made of their behaviour while in their cots in the new-born nurseries, and while with their mothers during feeding.

Chapter II

REVIEW OF THE LITERATURE

Though concerted study of individual differences in human neonates has not yet been undertaken, there is a considerable body of literature which has more or less direct bearing on this topic. In the course of many different researches, a wide range of methodologies have been used and a considerable, though scattered body of information on neonate characteristics has been assembled. In addition, many implications for the design of a study such as this are to be found. The literature will therefore be discussed under the headings:

1. Methodology
2. Characteristics of neonates revealed by previous studies.

1. Methodology

To obtain data about individual behaviour, both experimenter and clinician can generally look to a greater or lesser extent to two sources, which are, what he himself observes, and what the individual or other people tell him. With infants, however, methods which require the individual to introspect or speak cannot, of course, be used, and casual information gathered by untrained observers is not very reliable. Consequently the researcher is dependent on his own observations. There are two

ways in which these observations can be made: first, through application of experimental procedures, and secondly through naturalistic study of infants in their natural setting. Owing to the limited capacities and restricted environments of neonates, however, the distinction between the two methods is less marked at this age than when older children or adults are used as subjects.

Both methods have their particular strengths and weaknesses, which will be discussed separately in the following paragraphs.

(a) Experimental procedures

Experimental procedures are distinguished chiefly by the way in which they limit the behaviour that is to be studied. The individuals' responses or failure to respond provides the data on which conclusions are based. Some particular reaction is chosen, or a specific function is designated as the area of study and conditions are arranged so that this factor will assume maximum importance and suffer minimum interference from outside sources. Some form of stimulation is usually necessary to evoke the particular piece of behaviour that is to be studied, though occasionally naturally occurring activities are the subject of interest. In the latter case it is the conditions of recording, rather than the methods of stimulation, that are controlled. A comprehensive review of these two types of experimental situations has been published by Richards & Irwin (1934).

The method has, of course, been used in more recent times, and a study by Graham (1956) is a good example of modern experimental techniques.

The experimental method does not seem well suited to the purpose of clarifying the range and forms of variability in neonate behaviour for several reasons. First, experimental studies that are available to date have not greatly increased knowledge of the infant as a functioning organism, despite their production of voluminous literature on his sensory potentials and reflex mechanisms. Most experimental studies have only reported percentages of infants who did or did not respond in a particular way. They may indicate that ranges of individual difference were found, and state that uncontrolled factors might have played a larger part than had been supposed, but they throw little light on the conditions which determine responsiveness, and do not indicate whether or not the same infants would have reacted in the same way should the experiment have been repeated within a matter of hours.

The importance of these limitations is illustrated by a study done by Wagner (1937). He was endeavouring to establish a criterion that would define sleep in newborn infants. Eventually he achieved his end by defining it in terms of relative duration and extent of responses to external stimuli that were elicited from neonates who were judged to be sleeping. The fact that responsiveness might be closely associated with physiological state has been ignored by most experimentalists, who were content merely to use infants who were quiet and not crying.

The fact that areas which might prove significant for the study of individual differences have not yet been defined further limits the value of the experimental method for the study of neonates at the present time. Material that has resulted from use of experimental procedures is diverse and plentiful, but it lacks co-ordination, and emergent principles which might relate to constitutional differences among neonates are hard to find. Experimental methods may yield precise measurements of isolated discrete variables but which of these are relevant is not yet known, and it seems preferable to examine broader expanses of infant behaviour before restricting investigation to any particular piece of behaviour.

(b) Naturalistic observation

This consists of systematic observation of subjects as they live their normal lives. No attempts are made to stimulate or inhibit particular forms of behaviour, but as accurate as possible a record is obtained of what actually takes place. Since this method sets relatively few limits on the behaviour that can be observed, it seemed particularly applicable to study of one newborn baby, whose range of activity is so restricted that it should be possible to cover almost the whole of it.

Despite the superior applicability of the naturalistic method to the study in hand, there are several weaknesses in this type of approach which have been well illustrated throughout the writing of infant study. The flood of baby biographies that followed Darwin's 'Biographical Sketch of an Infant' (1877) were

subject to most of them, and did much to throw the method into disrepute. Though a mass of material was collected through these recordings this was based on casual and incidental observation and was laden with inaccuracies, unjustified interpretations and projected adult feelings and values.

It is only in fairly recent years, when researchers, who were unwilling to sacrifice the scope and flexibility of the naturalistic method, set out to improve its techniques, that this method of research has regained its respectability (Cattell 1957). It is now recognized that the variables of human fallibility should be excluded or controlled as far as possible and many devices, such as rating scales, counting procedures and spaced observation periods have been devised with this objective in view. Particular attention is usually given to the selection and training of observers and the conditions under which observations are carried out, and recordings made are standardized as far as is possible.

Methods by which in the present study the problems inherent in naturalistic observation of babies were dealt with will be described in a later chapter on the collection of data.

The two following studies are examples of research in which the naturalistic method has been used. It will be evident that techniques of control and standardization vary widely and that some naturalistic studies can, without sacrificing flexibility or breadth of outlook, come close to the precision and control that is a feature of the experimental method. At the one extreme

there is the all-inclusive but subjective article by Blanton (1917) which describes reflexes, crying, vocalizations, birth behaviour and many other activities, most of which occurred and were recorded under circumstances which resembled casual observation. At the other there is the more restricted, but none the less comprehensive investigation by Irwin (1930) on the Amount and Nature of Activities of Newborn Infants under Constant External Stimulating Conditions. In this study haphazard stimulation from the outside world was eliminated through use of a specially designed cabinet in which infants were placed during observation, and standardization of recording was ensured by use of mechanical techniques, descriptive codes, and trained observers.

2. Characteristics of neonates revealed by previous studies

A group of studies that were done by Irwin (1930, 1932a, 1932b) is of particular importance to the present research because it represents an attempt to describe spontaneous activities in neonates, and because the methods of observation employed were similar to those selected for use in this study.

The objectives of Irwin's earliest piece of research (1930) were twofold: to investigate the amount of activity exhibited by infants, and to study the nature of their reactions. For these purposes, each of four babies was observed for fifteen to eighteen hours a day, in the specially designed stabilimeter cabinet. This piece of apparatus was equipped with mechanical pens which recorded the number and amplitude of all movements

made by the babies. Activities were also described by trained observers who, using a shorthand code, recorded them on a moving polygraph tape.

The 'Ratio Index' used for analysis of the amount of movement consisted of three parts, and these are described by Irwin (1930, page 17) as follows:

> % Frequency of Moves means that of all movements in a given unit of time the leg movements are a certain %. To illustrate:
>
> $$\frac{3 \text{ leg movements}}{68 \text{ total movements}} = 4\%$$
>
> Movements per unit time means that a given number of movements occurs at a rate of say 35 movements in one hour.
>
> Oscillations per unit time means that a given number of mechanical pen movements occurred at the average rate of say 36 oscillations per minute . . . an oscillation is defined as an excursion and return of the pen on the polygraph record.

These definitions are not too clear, but it seems that the polygraph tapes were divided for analysis into ten-minute sections and that calculations were based on the amounts and types of movement found recorded in each section.

Results indicated that movements increased from the first to the tenth day, and that anterior segments became more active than posterior ones as the child matured. In addition, one infant was found to be consistently more active than the others.

Study of the nature of infant reactions led Irwin to the conclusion that there are two types of behaviour shown by

neonates. These he described as 'specific movements' and 'mass movements'. His criteria for distinguishing between them follow:

Criteria for specific movements
a) They involve a single segment
b) Their rate is slow enough to be discriminated by a trained observer.

Criteria for mass movements
a) Stimulation acting on widely distributed sense organs, either external or internal initiate it. This means that during mass activity definite sensory points are not connected with definite motor points as is characteristic in specialized patterns of behaviour.
b) Organismic or non-segmental character. Whole body including segments is involved.
c) Exaggerated or excessive movement.
d) Almost total lack of effective modification of the physical environment.
f) Movements usually too rapid to be described by recorders (Irwin 1930, page 60).

Irwin also noted that vocal sounds are components of mass activity and said that he failed to find any recognizable emotions such as love, fear or rage in the infants.

Irwin's later writings (1932a, 1932b) describe a study in which the activities of 73 newborn infants during intervals between feeding periods were examined. The same stabilimeter cabinet and mechanical pens that were used in an earlier research, were employed again. On this occasion, however, the babies were studied for only 3 hours each.

Results showed that individual babies differed widely in the amount of activity they displayed and it was also found that while 66% of the babies were most active before feeding,

33% were liveliest after. Their motility was also increased by wetness, and it was found that activity tended to increase on certain days, notably the 3rd, 5th, and 9th.

This study is of interest because Irwin, while saying that there were no criteria for assessing whether or not infants were sleeping, suggested several possible ways of distinguishing between sleep and wakefulness. These were 'eyes open, or closed, posture, blood pressure, respiration, muscle tonus or nature of activity.' Neonates who were judged to be asleep were six times less active than those who were wakeful.

The works that have just been referred to influenced the present study in the following ways: They confirmed judgments from other sources that differences might be found among neonates, and they suggested that one of the forms of variation might be differences in the level of physical activity. They also offered criteria for differentiation of infantile types of movement which Irwin described as specific and mass movements, and indicated that there are behavioural states such as sleep and wakefulness which could be distinguished from one another because infants were more active when awake than when asleep. In addition results suggested that the infant's feeding schedule should be taken into account when planning observation periods, and indicated that wetness may disturb a young infant.

There have been many other studies that are relevant and though the picture obtained from them of the factors that influence neonate behaviour is by no means complete, it does suggest certain

considerations that should be borne in mind when subjects are selected, and it points to many variables that should be controlled if equivalent observations are to be obtained on different infants.

Factors which influence the behaviour of neonates seem to fall into three main divisions. The first includes physiological states such as hunger, freedom from pain, cold, etc., which are fluctuating and of comparatively short duration. The second covers environmental conditions such as noise, light and temperature and all other external stimuli. The third group contains those conditions which arise from the pre-natal and natal circumstances of the child.

Among the physiological influences, hunger seems to be the most thoroughly studied. Results of studies by Taylor (1917) and Richards (1936) support Irwin's conclusions that motility and also crying are influenced by the feeding schedule and the proximity of the next meal. Hunger contractions, however, do not necessarily produce these reactions and Taylor found infants who slept through strong stomach contractions.

A somewhat different study was done by Halverson (1938) who was interested in feeding patterns and who designed an apparatus for measuring the strength and variations in the sucking pace of nursing infants. Halverson concluded that there were several distinct sucking patterns and also a wide variation in the strength that different babies exerted when feeding. He also noted differences in initial skill and learning ability.

Wetness was found by Pratt, Nelson, and Sun (1932) to be related to activity and crying in babies. They concluded, however, that it was the chilling effect of evaporation, rather than actual wetness, which probably disturbed the infants. The results obtained by Aldrich, Sung and Knop (1945) who found crying to be related to the amount of nursing care that was available, probably support this conclusion, since it can be assumed that when nurses are plentiful, babies will be changed far more frequently.

Richards (1935) attempted to find a physiological index that was highly related to activity. He studied the interrelations of body temperature, pulse rate, respiratory quotient, heat production and muscle activity, but concluded that no such index could be found using the measures he employed.

The effects of external stimuli such as light, sound, smells, pain applications, etc., have been explored in many different studies, and it is evident that under certain circumstances infants are affected by all of them. Light, sound and temperature are likely to be the most important variables in a naturalistic study of young infants, however, and research by Pratt (1930) into the effects of repeated visual and auditory stimulation is important. This worker found that after an initial increase of activity in response to new stimulation, a period of adaptation set in, in which the infant adjusted to the new intensity, and its activity remained constant, or failed to increase in proportion to increased stimulation. These

results indicate that gradual changes in light intensity and noise level may not greatly affect the behaviour of infants.

The crying of other infants is probably one of the most frequent stimuli in the life of a newborn babe, and is a variable which should be considered. An article by Blanton (1917) includes a section in which an experimental investigation of the effects of this noise was carried out. As a result it was concluded that no social influence was exerted by the crying of other babies on children younger than fifteen days of age. These results were confirmed by Aldrich, Sung and Knop (1945) in the study referred to earlier.

The significance of foetal environmental differences is dealt with by Sontag (1941) He discusses the influence of drugs and toxins and also some effects of maternal nutrition, endocrine dysfunction and psychological state, and describes ways in which each of these may affect the neonate. There is also an article by Bryan (1930) which reports a study of 64 mothers prior to delivery and a follow-up investigation of their infants for ten days after birth. The postnatal characteristics of the babies are described and some relationships to type of delivery are discussed. In a third study, Fries (1941), in a paper on mental hygiene in pregnancy, delivery and puerperium, mentions some aspects of maternal psychological state which might influence infant development.

As has already been mentioned, much research has been done on the sensory and reflex equipment of the neonate, and

this has been summarized by Pratt in Carmichael's Manual of Child Study (1954). This review indicates that the newborn infant is capable of reacting to visual, auditory, tactile, pain, gustatory and some olfactory stimuli, but that his responses are often of a crude, non-specific sort. Many reflex patterns are also described and these range from babinski toe responses to startle patterns, tonic neck and sucking reflexes. A comprehensive, if fragmentary picture of the infant's attributes and capacities is therefore to be obtained from this review.

Special attention should, perhaps, be drawn to a summary which has been published by Dennis (1934). He was primarily interested in the maturation of human behaviour and has listed nearly eighty different responses which can be found in normal neonates. Dennis points out that the repertoire of the newborn child "does not consist of 'a few squirmings', but is surprisingly large." In contradiction to many other writers, he maintains that responses far from being random and unorganized are by definition, patterned. If this is so, then variations that are apparent in the patterns of young babies may represent differences which will be significant in later development.

A rather different approach has been taken by Ribble (1938) who published an article on instinctive reactions in newborn infants. This writer stated that she was interested in the study of infant reactions so that the subtle relationship between the physiological and the psychological may become clearer and a new understanding may be found of forces leading

to psychic organization and disorganization. She was struck by the wide variety of behaviour displayed by normal infants and gained the impression that:

> Newborn infants may be roughly classified into two groups: the larger, organized at a reflex level of activity with instinctive energies well mobilized in a state of biological attention, expectancy, or more exactly, hunger for tactile stimulation; the smaller 'vegetative' group, which, until they are repeatedly assisted and stimulated, are not ready to make a sensory-motor adaptation but continue to function in a foetal way (Ribble, 1938, page 152).

Summary

Review of the literature confirmed the impression that if suitable techniques and controls are used, the advantages of the naturalistic method of studying infants can be realized without undue loss of accuracy and objectivity in collection of data.

In addition earlier studies indicated that conditions of infant behaviour such as sleep and wakefulness have not been properly defined, nor has their relationship to states of motility which Irwin has named 'specific activity' and 'mass activity', been explained. Further study might throw more light on these phenomena, and on the levels of reflex and vegetative organization that were described by Ribble. It would also permit Dennis's thesis, that the activities of infants are patterned, to be checked.

Findings of previous researches suggest several variables that should be taken into consideration in planning studies of

infants; among them were hunger, physical comfort, age, temperature, light and sound.

These results were borne in mind when the design that is to be described in the next chapter was planned.

Chapter III

METHOD OF COLLECTING DATA

It has been mentioned earlier that the object of this study is to uncover those features of infant behaviour that might be the forerunners of personality differences later in life. It was therefore obvious that the differences that were sought must have a certain degree of permanency, and should be shown in a fairly consistent manner throughout the period of observation. Single incidences of behaviour could not, by definition, be considered significant or characteristic of the particular infant.

The problem of defining consistency in this connection is, however, a complex one. Though a degree of stability in infant behaviour is to be expected, this is the time of life at which changes occur very rapidly, and natural patterns of development may involve substantial change over short time periods. It was therefore necessary that whatever criterion was used should allow for the variable nature of the organism that was being studied. Knowledge as to the nature and extent of changes that could be expected is lacking, therefore since it was differences between individuals, not magnitude of change that were the subject of interest, it was decided that external standards should be dispensed with and babies merely compared with

one another. It was assumed that real differences, if present, would be noticeable over a period of time, and would be manifested consistently throughout a series of comparisons. It was assumed, for example, that if an infant were constitutionally very active, he should remain among the most active subjects in the group, regardless of the actual amount of activity that he showed.

Consistency was assessed by the degree to which different infants maintained their position relative to each other. In fact, it was assumed that should babies be ranked with regard to a particular attribute, their order should remain fairly stable from one observation period to the next.

Collection of data was planned therefore in such a way that equivalent observation periods would be spaced throughout the week during which infants were studied.

1. Subjects[2]

This study is concerned with descriptions of differences that occur in a normal infant population. For this reason babies who showed gross deviations associated with pathology were omitted. The subjects chosen included only those who, in the light of medical judgment at the time of birth, were expected to develop normally into healthy children and adults. Within

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2 All infants were born and then studied at the Vancouver General Hospital.

this category were included four infants delivered by Caesarian section; one infant who had required resuscitation; and two others whose birth weight was a little low (see Table I). In spite of the fact that the circumstances of their birth were somewhat unusual, these infants were considered by medical authorities to be essentially normal babies whose potential for future development was unimpaired. Judgments as to the infants' 'normality' and potential for growth arose out of the medical assessment of the infant at birth. All the infants studied were classified as full term deliveries, and with the exception of three Caesarian and one resuscitated infant all were considered to be in good condition and were sent directly to the ward nurseries. The four exceptions just mentioned were sent to the premature nurseries for special care during the first 24 hours, but all were returned to the ward nursery on the second day of life, at which time they were considered by doctors to be progressing normally, and to meet the criteria we required in selecting subjects for this study.

The group consisted of 39 infants, 21 of whom were male and 18 female. As is shown in Table I, ten males and ten females were breast fed, while ten males and eight females were bottle fed. All but the two smallest babies were on the normal four-hourly feeding schedule. These two underweight infants were fed at three-hourly intervals.

TABLE I

TABLE I

SUMMARY OF INFORMATION DESCRIBING SUBJECTS

DELIVERY	Normal Route	35	Caesarian Section	4
CONDITION	Good	38	Needed Resuscitation	1
NURSING CARE	Ward Nurseries	35	Premature * Nurseries 3 Caesarian infants 1 Resuscitated infant	4
SEX	Male	21	Female	18
FEEDING METHOD	Breast 10 male infants 10 female infants	20	Bottle 11 male infants 8 female infants	19
FEEDING SCHEDULE	4-hour ** intervals	37	3-hour intervals	2

*All these infants were transferred to the ward nurseries after 24 hours

**Six of these infants were not fed during the first 24 hours.

2. General Characteristics of Observation and Recording Procedures

Each infant was observed during at least ten and usually eleven different periods during the first week of life. All observations were carried out by the same observer, and the same general procedure was followed at all times. Conditions in the setting, while varying during any given period, were on the whole similar for all subjects.

During eight of his observation periods the infant was in his cot in the nursery (cotside observation) and during the remaining two or three he was with his mother being fed (feeding observation). There are differences in the number of feeding observations because six of the babies were not fed during the first day of life for medical reasons.

Since infants could not be watched for 24 hours a day, it was necessary to select samples of behaviour which would be as representative of their activities as possible. The two situations mentioned above were therefore chosen. Newborn infants spend by far the greatest part of their time in their cots and the bulk of the observation time was therefore devoted to recording the type of behaviour which occurs spontaneously when the infant is on his own. Feeding, however, is probably the most important event in the daily routine of a young baby and is also a subject that has aroused much interest among psychologists who are concerned with explaining human development. For these reasons it was decided to include feeding periods in the

observations. As the lives of neonates are so restricted, almost the whole of their activities can be covered by study of their behaviour in these two types of situations. Some differences might occur in reactions to handling during such situations as diaper changing, bathing, etc., but control of these situations is beset by so many practical difficulties that it was decided to exclude them.

Infants were observed on the first, third, and fifth days of life, and were between the ages of 4-16 hours on the first day, between 52-64 hours on the third day, and between 100-112 hours on the fifth day. This restriction of age range was decided upon because several factors indicated that observations should be carried out within rather narrow ranges. First, there are indications in the literature that during the first week of life increases in movement can be expected on the third and fifth days (Irwin 1930). Secondly, there may be patterns of behaviour which are related to the problems of adjustment to post-natal life and which are therefore affected by the nearness of birth. Thirdly, the effects of age may be sufficiently important at this period of rapid growth to make noticeable differences in infant behaviour from one day to another. All these considerations indicate that observations which are carried out more than one day apart might not be equivalent.

Observations were carried out by means of continuous recording, and the observer did not focus on any particular type of behaviour, but endeavoured to capture and write down all that

occurred during the period under study. In this way as complete as possible a record of the infant's behaviour was secured. The process of designating areas of difference was left to a later time when individual protocols were analyzed.

In order to facilitate the process of recording, arbitrary codes were used. One was based on the code described by Irwin (1930) in his monograph on the activities of newborn infants under constant external stimulating conditions. The other was developed to suit the special requirements of the feeding situation.

While the general methods of observing and recording were the same in both situations, differences in the circumstances and activities of cotside and feeding observations required some differences in procedure. The details of each set of procedures are described below.

3. Specific Details of Cotside Observations

As has been stated previously, each infant was observed eight times at the cotside; twice during the first 24 hours and three times during each of the third and fifth days of life. Each observation period lasted for thirty minutes, since this was considered to afford the best compromise between observer fatigue and the need to prolong study periods. It was felt that observation periods should be fairly lengthy if proper perspective was to be gained between those activities that occur

only briefly and those which are sustained. In addition some significant pieces of behaviour might be very fleeting, and hence easily missed during short, broken periods of study.

(a) Timing of observations

As has already been mentioned, observations were collected on the first, third, and fifth days during age ranges that were strictly limited. These ranges were further broken down for the purposes of cotside observation, and data were collected during times that were as far as possible, equivalent for all neonates.

Reference to the literature indicates that infant behaviour might be expected to vary at different periods during the feeding cycle. As mentioned previously, studies by Irwin (1932) and Richards (1936) also Taylor (1913) indicate that increases in motility are likely to be shown before feeding, and it is also generally accepted that hungry babies cry. For these reasons and because eating is probably the most important event in the life of the young infant, observations were planned to take full account of the feeding schedule.

These plans were facilitated by the routine in the infant nurseries which followed a rigid time schedule that was the same on each day of the week. Thanks to the limited number of tasks that had to be performed, there was little variation throughout the twenty-four hours in the cycles of feeding, changing, resting and changing again before feeding. Infants were fed on a

four-hourly schedule and spent approximately one hour in four with their mothers. They were fed at some time during this period. The remaining three hours were spent in the nursery, and it was during them that cotside observations were made.

The time that infants spent in the nursery was divided into the period before feeding, the period after, and the period between meals. All these times were of equal length, and the half hour observations that were made on infants were fitted into them. Thus babies were studied for half an hour during the hour after feeding, for half an hour during the hour between meals, and for half an hour during the hour after feeding. The same principle was applied in the cases of the two babies who were on three-hourly schedules, except that in these cases the half-hourly observation times were fitted into 40-minute periods before, between, and after feeding instead of 60-minute ones.

(b) Heat, light and sound

Little control was possible over these factors, since observations had to be carried out in the ward nurseries. Records were kept, however, of the temperature, time of day, and approximate degree of noise. Changes in temperature and light were gradual of onset and it is probable that infants were able to adapt to them progressively as they occurred.

Noise levels varied considerably from one period to another and may have affected the behaviour of infants upon occasion. All neonates, however, were observed during conditions

of fluctuating noise and so all were subject to this disturbance to some degree.

(c) Wetness and soiling

Wetness and soiling constituted a problem in this study, since it was necessary that the spontaneous activities of infants be interfered with as little as possible. The procedure followed was chosen as the best compromise between allowing a baby to be disturbed by the chilling effect of wet diapers, and disturbing him in order to change them. This procedure consisted of changing the diapers of wet and crying infants before the observations were started, but leaving babies who were contented as they were. Babies who became uncomfortable during observations were not changed unless this occurred fairly near the beginning of the period. In this case observations were resumed when the child had settled down to a steady state again.

(e) Interruptions

These were unavoidable, and were due to many causes. When possible, observations that had been interrupted were discontinued and resumed at an equivalent period later in the day.

(f) Observer bias

All recordings were done by the same observer, so distortions caused by differences in recording technique should be minimal. Use of codes also ensured that ambiguities due to semantic confusion were as few as possible.

(g) Observer's procedures

During the half hour periods in which babies were observed in their cots, they were clothed in diaper, vest and nightdress, but the bed clothes, which normally covered them, were removed for all but the observations of the first day. In this way, limbs and extremities were made visible. In the case of newborn infants, however, warmth was important, so the blankets were arranged to cover the body but leave most of the limbs free.

While removing or arranging blankets, the infants were checked for wetness and soiling, and diapers were changed when necessary. No attempt was made to standardize the posture of the infants, since the procedure called for a minimum of interference with naturally occurring behaviour.

When all preparations had been made, the observer stationed herself beside the infant's cot and commenced recording on a specially designed form which will be described presently. This form, together with a stop watch, was fastened to a clipboard for support.

Coded notations of all behaviour events and changes in behaviour states were made in the second and first columns of the record form, and the exact time of occurrence was noted from the stop watch, and written down in column three. This procedure was followed throughout each 30-minute observation period.

At the end of each period a note was made of the temperature in the nursery, and a brief description of the amount and type of noise was recorded. Any unusual events or interruptions were also noted.

Before recording started, a coded description of the baby's state of sleep or wakefulness, wetness or dryness was made and his posture was noted. If he was still enough, a quick sketch of his position was made as well.

The record form used during cotside observations contained spaces in which the infant's name and age as well as his time of birth and of being observed, could be recorded. There was also a space for description of the child's initial posture and state, and for the name of his doctor.

The record form contained three columns in which data were written one beneath the other. The type of material that was recorded in each column is shown in Table 2.

Since, however, the dimensions of the paper on which recordings were made were broader than required, two sets of columns were printed on each sheet, then the sequence of events could be continued from the bottom of the first set to the top of the second on the same page.

A specimen record sheet is shown in Appendix A.

TABLE 2

TABLE 2

TYPES OF DATA RECORDED IN COLUMNS OF COTSIDE RECORD FORM

Col. I Behaviour states	Col. II Activities	Col. III Time
Infant's state - specific activity - mass activity Crying Disturbing events in nursery - sudden noises - cot shaken	Muscular movements - body - limbs - extremities - head - face Throat sounds and vocalizations Gastro-respiratory events - micturition - defecation - vomiting - sneezing - yawning Movement patterns of mass activity - details of mass activity (where possible)	Time notations (written opposite events to which they referred)

4. Specific Details of Feeding Observations

Each infant was observed at least twice during feeding and most were seen three times. These observations were carried out on the first, third, and fifth days of life, and within the same age ranges as were the cotside observations. Data-collecting periods were not of uniform length, however, since recording began with the mother's first attempts to feed the infant, and continued until such time as she terminated the meal, or in the case of bottle-fed babies, until the bottle was empty.

Primary emphasis was placed on the need for maintaining good rapport with the mother as it was felt that self-consciousness or discomfort during observations would seriously interfere with normal feeding patterns, particularly where breast-fed babies were concerned. This resulted in the use of far more flexible procedures than those which were employed in the infant nurseries during cotside observations.

Mothers were given a brief description of the research which was being done, and their willingness to permit observation while they were feeding their babies was ascertained before their infants were included in the study. It was made clear that the observer did not wish to interfere in any way with the normal course of events, but would be making a written record of the baby's behaviour.

The record form for feeding observations (Appendix B) provided space for the same general information as did the cotside

form, but horizontal lines were drawn across it at intervals of approximately three-quarters of an inch. Data were recorded in code along these lines in sequence, as they occurred, and time notations were made next to the events that they referred to.

The following events were recorded:

Infant takes nipple

Infant loses nipple

Sucks - a separate verticale stroke for each one.

Pauses - a horizontal dash

Manipulations of bottle or breast by mother

Manipulations (other than bottle or breast) designed to hasten or soothe the infant

Burping

Crying

Any other events

The same type of procedure was followed as in cotside recordings. The observer stood beside the mother's bed with pen, clip-board and stop watch, and wrote down events as they occurred. During feeding observations, however, recording was sometimes hampered when nurses assisted mothers with their infants, and when a clear view of the babies was difficult to obtain. In addition, infants, instead of being dressed only in shirts, diapers and nightgowns, were totally wrapped in blankets for the sake of hygiene and warmth. For these reasons feeding observations were less complete than those obtained at the cotside.

Since accurate observations were harder to obtain during feeding, special attention was given to reports which were made after the meal. These contained a brief evaluation of the mother's personality, her attitude to the baby, and a description of the way she handled it. Spontaneous comments made by her about her child were also put down. The infant's responses to handling, its vigor of feeding, starting difficulties and any other noteworthy behaviour were described also. In addition a note was made of any special events or disturbances that had taken place.

Chapter IV

METHOD OF ANALYSING DATA

Information gathered during cotside and feeding observations differed greatly both in quantity and quality. Consequently the two sets of data were analyzed separately, by different methods, and with different ends in view.

1. Method of Analysing data from cotside observations

From the data obtained from cotside observations, it was intended that infants be compared with one another in terms of several characteristics of their motility. Before such comparisons could be made, material included in the cotside record forms had to be classified and summarized. To do this, it was necessary first to establish criteria for differentiating behaviour states.

Irwin (1930) used this term, behaviour state, to refer to two types of infant motility conditions and levels: a "mass movement state" in which activities were large in number and involved the body as a whole, and a "specific movement state" in which activities were both fewer in number and segmental, involving only a part or parts of the body. Preliminary examination of our protocols suggested that the "specific movement state" should be broken down into two states because it actually included two different types of motility. Both were characterized by a

condition of relative tranquility but in one there was a considerably larger number of segmental movements than in the other.

In view of this evidence from our protocols, we established three categories of behaviour states: mass activity, sleep, and specific activity. The following describes their nature and the criteria by which each was defined.

(a) Mass activity state: This is like Irwin's "mass movement state." The criteria for defining and identifying it were changed, however, because as Irwin himself remarked (1930), some that he used failed to differentiate it adequately from the "specific movement state." We judged a mass activity state to be present when any one of the following occurred:

(i) When there was basically a condition of body tension from which a continuous state of movement arose.

(ii) When there were closely consecutive movements which involved three-quarters of the body. Trunk, head, arms and legs were considered as separate quarters for this purpose.

(iii) When movements were too rapid and complex to be recorded separately and fully.

(b) Sleep state: This refers to the state of tranquillity where there were few segmental movements.[3] As we saw

3 Head, right arm or hand, left arm or hand, right leg or foot, left leg or foot were counted as separate segments.

it, this state generally began with a sudden drop in the number of movements per minute followed by a sustained period of quietude. Later recovery to a higher level of activity usually was rapid. A sleep state was judged to be present in the following circumstances: (i) there was a two-minute period in which not more than one segmental movement occurred, followed by several consecutive minutes in which there were not more than two segmental movements per minute. (ii) This lowered activity level lasted for at least three minutes.

An exception was made when a single startle response or change of position, which involved several body segments, was followed by two or more minutes of quietude. In this case, though the movement involved several body segments and numerical totals might rise above two per minute, the event was very brief.

(c) Specific activity state: This refers to a relatively tranquil state in which the amount of activity exceeds the limits outlined in the criteria which define the sleep state.

Calculations which show the actual extent of difference in the amounts of movement during the states we have named sleep and specific activity will be presented and discussed later in this chapter as well as in Chapter V.

On the basis of the foregoing criteria, material in each cotside record form for each infant was classified for behaviour state, and every example of each state of mass activity, sleep, and specific activity was indicated by an appropriate mark. Different coloured inks were used to show different types of behaviour states. From this point, three different lines of analysis were undertaken.

(a) The sequences and durations of behaviour states shown by each infant during each cotside observation period were charted.

(b) The separate movements which occurred during sleep and specific activity states were analyzed in several ways.

(c) The movement sequences during mass activity states were classified and tabulated.

The procedures used in performing these operations and the analyses which followed from the results of some of them will now be described.

(a) Charting of sequences and durations of behaviour states

For each of every infant's cotside observation periods, a chart was constructed on which data were recorded in a way that would show when, how, and in what order the mass activity, sleep, and specific activity states of that period occurred. These data were extracted from the cotside record form, which

had been marked, as previously described, to differentiate and designate examples of the three types of behaviour states.

As can be seen in the specimen reproduced in Appendix C, the chart contains five columns. The number of minutes spent by the infant in each sleep, specific activity, and mass activity state was read from column three of the cotside record form, and listed respectively in the chart's first, second, and third columns. In column four were recorded crying incidents. Though these came usually during mass activity, there were some that occurred during specific activity states. Column five, which was required only a few times, was used when a borderline condition made distinction between specific and mass activity states impossible.

By reading the first three columns of the chart from left to right and then returning to the left-hand column, the sequence of behaviour states was obtained. Also computed from each chart were the number of changes in behaviour states which occurred during a particular observation period and the proportions of the total time for that period for which each type of behaviour state existed.

On the basis of some of the data derived from the charts just described, infants were compared with one another, first in terms of the amounts of time spent by them in different types of behaviour states. Because it was thought that some infants might be more disposed to sleep and others to mass activity, the following procedures were applied.

Proneness to sleep, specific activity, or mass activity were assessed by totalling the amounts of time each infant spent daily in each of these behaviour states. The babies were then ranked according to the time that each spent in sleep, and again according to the time that each spent in mass activity on each of the days during which they were observed.

As will be remembered from the discussion in Chapter III, the basis for assessing the consistency of infant behaviour was to be the extent to which individuals of the group maintained their positions relative to one another. Therefore, once the ranking of the babies had been completed, it was necessary to compare the rankings obtained from different observation periods to see whether or not the ordering remained more stable than would be expected merely on the basis of chance. A non-parametric statistic which had been developed by Kendal and named Tau, (Siegel 1956, pages 223-229) was used for this purpose.

It was decided that should a consistency which would be likely to occur only five times in one hundred or less be found, we would consider that the infants did indeed tend to be consistent in the amounts of sleep and mass activity that they showed. This would strongly suggest the presence of constitutional differences in motility.

If, however, no significant amount of consistency were found when infants were ranked, there might still be some babies who were persistently more or less active than the majority.

The rankings were therefore inspected to see whether or not any babies were within the top or bottom 25 per cent of subjects on each of the three days of observation.

The data obtained from charting the sequences and durations of behaviour states, were used also as the basis for comparing infants in terms of their tendencies to change from one behaviour state to another. For this purpose, the changes of state that occurred in each observation period were counted and the average number of changes that took place per day was derived by summing the separate counts and dividing each sum by the number of half-hour periods during which the infant had been studied. Thus the total number of changes was divided by two on the first day, and by three on each of the third and fifth days. It was proposed that should the likelihood of consistency be suggested by inspection of these averages, infants would be ranked or grouped in the manner that was applied when infants were compared for amounts of time spent in different types of behaviour states.

(b) Analysis of movements during states of sleep and specific activity

The movements occurring during states of sleep and specific activity were analysed in several ways.

(i) Classification and tabulation of movements. Examination of cotside record form portions, marked as states of sleep and specific activity, suggested that movements of different infants might vary not only in number, but also in part or parts

of body involved, and type of movement performed.

For this reason, a movement classification sheet, from which various counts of movements could be made, was constructed for each cotside record form. As seen in Appendix D, body parts were listed along the vertical axis. For this purpose, five body parts were distinguished: head, face, arms, legs, and extremities. Along the horizontal axis of the movement classification sheet, six types of movement categories were listed. These were:

1. Flexions, extensions, and changes of location.
2. Coordinated movements; that is, stretching and squeezing movements which were too well structured to fit into the first category.
3. Spastic movements, such as twitches, jerks, tremors, and sudden muscle tensions which did not result in movement.
4. Throat sounds.
5. Movements connected with respiratory or gastro-intestinal disturbances.
6. Movements of facial muscles.

Each movement shown on the cotside record form during sleep and specific activity states was transferred to the movement classification sheet, where it was represented by a stroke placed opposite the relevant body part and beneath the appropriate movement category. Different coloured inks were used for recording the movements of sleep and specific activity states so that separate analyses could be done on them.

(ii) Comparison of motility levels during sleep and specific activity states. Since the discrete movements shown in both sleep and specific activity states readily lent themselves to numerical counts from the cotside record form, it was possible to compute averages of the number of movements that occurred during an arbitrarily selected period of time. Such was done for two purposes in this study: first, to assess our criteria for separating sleep and specific activity states, and secondly, to compare infants with regard to their overall motility averages, and also in terms of their characteristic levels of motility during sleep and specific activity. For both purposes, a three-minute time interval was used because it would ensure that infants were well into the state being considered, and because it would provide adequate compromise between use of a non-representative period and from loss of subjects due to the very variable nature of infant behaviour states during the first days of life.

To show the actual differences in the amounts of activity during the states we differentiate as sleep and specific activity, the numbers of movements that occurred during each three-minute period of sleep were counted and summed for the whole group of babies. The mean for activities in three-minute sleep periods was calculated and the difference between it and the similarly derived mean for movements in specific activity states was tested for significance by use of the 't' test.

To assess the infants' motility levels, the average number of movements that occurred in three-minute periods on each

of the first, third, and fifth days was calculated for each baby who showed two or more periods of sleep or specific activity on every day. Results were then inspected with a view to ranking infants should consistent levels of motility seem apparent.

Owing to the sparsity of sleep during the first days of life, and to the rapidity with which the behaviour states of neonates change, only ten subjects were found who slept for six minutes or more on each of the three days. Likewise several babies had to be eliminated from the analysis of movement during specific activity, but thirty were retained. Results, therefore, are based on data from ten sleeping babies and from thirty during specific activity.

Sleep and specific activity were treated separately in this analysis, as it was not certain that infants who scored consistently high during one would necessarily do the same during the other. In fact, it was thought that differences might exist as to relative amounts of motility exhibited by an infant during sleep and specific activity. Thus, an infant who was consistently among the most active during specific activity, might be relatively inactive when asleep, and vice versa.

(iii) Amplitude of movements during sleep and specific activity. Observation suggested that the investigation of levels of motility might be supplemented by study of the amplitude of movements. It was seen that movements often tended to

radiate from an initial focus to a large body segment or to the whole body. Thus a minor twitch or finger flexion might initiate a generalized Moro response or other whole body activity. This generalizing effect seemed to take place regardless of where the initial movement took place.

In this study body parts were ranked according to the degree to which they were involved in the infant's activity. This ranking represents the proportion of extremity limb, head, and body movements to the total number of movements during any given time span and is similar to the movement percentages which were used by Irwin (1930).

Spastic movements also were included in the ranking as movements, despite the fact that they are counted also in the body part totals. This was done as it was thought that some patterns might emerge concerning the distribution of these movements during the days of observation.

(c) Classification and analysis of movement sequences during mass activity

Little attention has been given to the movements made by infants during mass activity. In view of this, it was thought that the suggestion made by Dennis (1934) that there are patterns in the apparently random behaviour of infants, should be investigated in connection with mass activity. We thought that if distinct patterns were found, infants might differ in the sorts of pattern that they showed, and might vary in the degree to which they manifested common patterns.

During preliminary observations it soon became evident that an attempt to record every detail that occurred during mass activity would be fruitless. Attention was therefore directed toward capturing the more important aspects of the behaviour taking place. Preference in recording was given to distinctive movement, repeated patterns, and activities that involved major portions of the infant's body. Striking, repeated patterns were thus given preference over minor details of activity.

Recording was not complete enough for actual counts of such activities to be meaningful, and somewhat different methods of tabulation from those employed in classification of specific activities had to be used. In this case salient patterns were extracted from the records and listed. Those which only occurred very rarely were dropped from consideration, and others which appeared to be more frequent, either in the group or in an individual infant were retained.

A search was then made through protocols for evidence of the sequences that had been retained. Instead of numerical counts being made, however, these patterns were scored in the following way:

Absent - No evidence of this pattern in a minimum of five minutes mass activity.

Present - This pattern was found from one to five times.

Marked - This pattern was found at least six times.

No infant whose protocol showed less than five minutes of mass activity per day was included in the analysis of movement patterns. This restriction resulted in the loss of twelve subjects, but was necessary if false assignment of 'absent' ratings was to be avoided.

The bottom level of the 'marked' category was set at the low figure of six so that the effects of prolonged periods of mass activity, in which numerical totals were increased but no new patterns added, could be avoided.

2. Method of analysing data from feeding observations

As compared with data from cotside observations, the data from feeding observations were scanty and would not allow inter-infant comparisons to be made. As a result, analysis of these data was directed towards comparisons between the bottle-fed group of babies and the breast-fed group, with a view to uncovering ways that the feeding method might affect infant development. With this purpose, the following analyses were undertaken.

(a) Differences in feeding situations of bottle-fed and breast-fed infants

During the collection of data, though interest had been focussed upon the behaviour of the infant, in such an intimate situation as this it was impossible to study infants without also considering the behaviour of their mothers. Data collection had therefore covered both neonate and maternal activities, and

analysis was concerned with factors that are relevant to the situation as a whole.

Data from feeding record forms and notes were classified as shown in Table 3.

TABLE 3

CATEGORIES FOR CLASSIFICATION OF DATA FROM FEEDING RECORD FORMS

Name of Category	Content of Category
(a) Pre-feed condition of infant	Infant described as sleeping, wakeful, or crying when handed to mother.
(b) Starting characteristic	Ease or difficulty in commencing to feed.
(c) Difficulties during feeding period	Types of trouble that occurred. - Could not find nipple - Too sleepy or too disturbed to suck - Lost nipple accidentally during feeding - Other miscellaneous difficulties
(d) Duration of Feeding	Time from start to finish of meal
(e) Attitude and personality of mother	Adjectives applied to mother in descriptive notes on meals.
(f) Mother's handling techniques	As described in feeding reports.
(g) Other comments	Comments re burping, interruptions, invisibility of infant, etc.

From the feeding reports, descriptive phrases which referred to the mother's attitude to her child and to the feeding process were represented by adjectives such as 'loving', 'confident' or 'impatient', 'worrying'. Those which described her handling techniques included remarks such as 'experienced', 'gentle', or 'inexperienced', 'clumsy'. These two categories were further subdivided, and remarks were classified as being positively or negatively toned, or neutral. A count was then made of the total number of phrases and adjectives of each type that had been applied to each of the bottle and breast fed groups, and the percentage of comments that had been positively, negatively, or neutrally toned was calculated. Groups were then compared with respect to the types of remark made about the mothers.

Information about infant behaviour during feeding periods was treated in a similar way, but in this case events and reactions were classified respectively as being 'frustrating' or 'evidences of frustration'. Difficult starts and losses of the nipple during sucking were considered to be frustrating events, and crying or exaggerated fussing during the meal was considered as evidence of frustration.

Groups were then compared with regard to the relative proportion of favourable and unfavourable comments that each received, and in terms of the number of frustrations that infants appeared to suffer from.

(b) Comparison of Behaviour States in bottle and breast fed groups

Ranking procedures that had been applied to the subjects as a whole were repeated for each separate group and Tau was again used to see if stability of state was in any way connected with the feeding method.

(c) Duration of feeding in bottle and breast fed groups

A comparison was made of the time spent by the two groups in sucking. Though, according to hospital prescription and schedule, breast fed infants were supposed to obtain sufficient nourishment in two minutes on the first day, five on the third, and ten on the fifth, it was noticed that some mothers continued to nurse beyond the specified limits, and breast feeding appeared to be a far lengthier process than bottle feeding. To see whether there were real differences in the time that these two groups took to feed, calculations were made to compare the amounts of time the two groups actually spent in feeding.

Chapter V

RESULTS AND DISCUSSION

1. Differences in Numbers of Movements during States Designated Sleep and Specific Activity

As explained in Chapter IV, the criteria used by Irwin (1930) for differentiation of behaviour states were judged to be inadequate. Because of this we developed new criteria to separate states of sleep and specific activity. Our data showed that whereas sleeping babies were found to average .9 movements per minute, specifically active ones were found to make an average of 3.8, and upon occasion performed as many as 8.0 different activities in one minute. Application of the 't' test showed that the difference between these means for amount of activity in each state was significant at the .01 level. This indicates that there is a considerable difference between the average amounts of motility displayed by infants who are sleeping and those who are specifically active.

Inspection of protocols indicates that this difference is qualitative as well as quantitative. Whereas a continuous series of segmental movements occurs during specific activity, during sleep long periods of unbroken stillness are characteristic. These often last for several minutes. Movements when they take place are usually very slight, and often involve fractions of segments only (for instance, an eyelid or a finger).

The reason for Irwin's failure to differentiate two behaviour state categories in his "specific movement state" is not clear. It may have been that he was not actually interested in describing conditions of infants, but merely in computing numerical totals of their movements; or again his use of several observers may have meant that no one person watched the babies for long enough to become aware of the changes that came over them. Possibly, also, the oversight was due to his method of processing data. He states that polygraph tapes were cut into ten-minute lengths, and averages of the numbers of movements were worked for each section. No mention is made of whether or not any distinction was made between 'specific movements' and 'mass movements' during this computation.

2. Results of Analysis of Sequences and Durations of Behaviour States

No consistency was found in the rankings of infants who had been ordered according to the amount of time that they spent in sleep and mass activity, that was significant at the .05 level of stringency. It was found, however, that infants who slept a lot on the first day tended to repeat this pattern on the fifth but not the third day. Tau approached significance for sleep states between the first and fifth days.

Study of the infants who comprised the top and bottom quarters of the ranges of sleep and mass activity revealed that only one baby was consistently among the longest sleepers. There were two, however, who never slept at all during observation

periods. Mass activity was even more variable. No child remained consistently in either the top or the bottom quarter for the full three days.

The actual amounts of sleep and mass activity that the infants showed were also very variable from day to day and from one infant to another. One baby was seen to sleep for nearly 57 minutes, or 63 per cent of the observation time, upon one occasion, and another maintained a state of mass activity for 78 per cent of one day, during which he was studied for ninety minutes. In general, however, levels of both sleep and mass activity were considerably lower than in either of these cases.

Similar findings were obtained from analysis of tendencies to change from one behaviour state to another. Results showed no consistency in the number of changes that occurred. Infants who remained for prolonged periods in the same state on one day did not tend to repeat this pattern on subsequent days.

The foregoing suggest that there are no apparent differences in variability of state or in proneness to sleep and mass activity during the first week of life. They do not, however, rule out the possibility that such differences might emerge during subsequent weeks when the physiological disturbances of the birth process are more remote.

The process of birth, which is most unlikely to have affected all infants in exactly the same way, together with the effects of anaesthetics which may have been administered to the

mother, plus the influence of postnatal maternal medication, form three factors which together or separately could disturb the infant's natural rhythms of sleep, specific activity, and mass activity. The exact effects that these factors might have are, however, a matter of speculation. Though it is known that the birth experiences of the four Caesarian infants were not normal, yet there was nothing in the patterns of their behaviour states to differentiate them from other babies.

Though an hypothesized consistency in proneness to sleep and mass activity was not found, inspection of the tables reveals a certain amount of information about the behaviour states of newborn infants. There is a steady increase in the number of babies who were seen to sleep during observation periods. Twenty-three did so on the first day, 27 on the third, and 31 on the fifth. As has already been mentioned, two babies spent the entire time in either specific or mass activity and did not sleep at all while being observed. From these results it would appear that sleep may not be properly established during the first week after birth. It is probably affected by the neonate's overall adjustment to extra-uterine life, and failure to sleep may be related to adjustment problems as well as, as is well known, to pre-term birth.

Specific activity was observed in all infants on all days, and mass activity was seen in all babies on the third and fifth days of life and in all but one on the first day.

3. Results of Study of Motility during Sleep and Specific Activity

The hypothesis that some infants are innately more active than others was not substantiated in this study. No consistency was found in the motility averages of infants. There were wide variations in the average number of movements per three-minute period, even when periods were adjacent to each other in time. Owing to this and to the fact that some protocols contained as few as two periods on some days, it was not possible to make comparisons of averages from one day to another.

Though the hypothesis is not substantiated by this study, neither is it necessarily disproved, since scarcity of acceptable observation periods, and the uneven distribution of them throughout the day greatly reduces the comparability of data on which the findings are based. No infant slept for three minutes during each observation period on each day that it was studied, and a similar distribution with regard to specific activity was also extremely rare. The controls instituted at the beginning of the study were in fact too crude to ensure equivalence of samples in an analysis of this sort.

As described in Chapter IV, amplitude of movements during sleep and specific activity was assessed by ranking body parts according to the frequency with which they entered into movements of the infants. This revealed no stable patterns that remained the same throughout the three days. Had arm and leg movements been counted separately instead of together, results similar to

those of Irwin (1930), who found that leg movements tended to predominate during the first few days, might have been obtained.

Spastic movements, which were tabulated with body part movements, showed some fairly consistent changes. They were comparatively more frequent on the third than on the first and fifth days. Twenty-one babies showed an increase in number of spastic movements on the third day of life, whereas five showed a decrease. On the fifth day the number of spastic movements dropped in twenty-two infants and increased in seven. The significance of these results is not clear.

4. Results of Analysis of Movement Patterns During Mass Activity

Search of protocols revealed six well defined, common patterns, and one tentative one. These were named 'patterned', 'co-ordinated', 'rhythmic', 'spastic', 'rolling', 'sucking' and 'propulsive' movements.

(a) Description of movement patterns

'Patterned movements' consisted of simple slashing or circling of one or more limbs. They were the least clear-cut of the types discovered, and were often hardly distinguishable from the general background of random activity. It seemed, however, that they were sufficiently structured to merit categorization.

'Co-ordinated movements' were defined as stretching activities which involved either flexion or extension of joints,

but which were distinguished from ordinary flexions and extensions by the amount of tension in the muscles, and by the length of time that this tension lasted. This type of movement might involve either just limbs, or the whole body. When the whole body was stretched there was a characteristic pattern in which the spine was hyper-extended and the head usually turned at the same time as the limbs flexed tightly. This was followed sometimes by extention of the limbs and flexion of the spine. These movements were frequent during mass activity, but also occurred during specific activity and sleep.

The term 'rhythmic movements' has been used to cover two types of seemingly well organized activity in infants. The first type is of relatively simple form. It consists of alternate slashing of the two arms or of both legs. These slashings resemble paddling, bicycling or stepping movements and are carried out in a rhythmic, regular way. The second type of rhythmic movement is more complex and involves all four limbs in a motion similar to the dog-paddling stroke in swimming. Once more the pattern is marked by its regularity.

'Spastic' movements have already been referred to in the section on specific activities. They include Moro responses, jerks of the body and limbs, and tremors.

Some babies were seen to turn their bodies during mass activity, and these movements which seemed to be a combination of hip swinging and spinal extension have been named 'rolling.'

'Propulsive' movements involved extensions of both legs and the spine which had the effect of propelling the infant towards the head of its cot. These may be a variation of the co-ordinated stretching movements that have been described earlier, but they have been tentatively given a separate classification, since they involve a jerkiness not seen in co-ordinated movements.

The term 'hand sucking' is self descriptive. It was used to refer to occasions when infants succeeded in getting either their fists or their fingers into their mouth and were seen to suck upon them.

(b) Occurrence of movement patterns in the group

Appendix E shows the distribution of mass activity movement patterns throughout the group. Types of movement are shown at the head of the vertical columns, while numbers in the left-hand margin represent the infants and their ages. Infants' code numbers are given in arabic numerals and their ages in roman ones. Blanks in the table indicate that the sum total of mass activity on the day in question did not amount to five minutes. The column at the extreme right shows the total amount of time spent in mass activity each day.

Some of the patterns described above occurred more frequently than others, and some showed special characteristic changes from day to day. These variations are shown in Table 4.

TABLE 4

DISTRIBUTION OF MOVEMENT PATTERNS IN 27 INFANTS DURING MASS ACTIVITY

	Day	Absent	Present	Marked
Simple patterned	1	7	11	9
	3	3	6	19
	5	2	4	21
Co-ordinated body	1	23	4	0
	3	11	6	10
	5	14	6	7
Co-ordinated limb	1	8	14	5
	3	1	10	16
	5	1	10	16
Simple rhythmic	1	8	12	7
	3	3	2	22
	5	1	2	24
Complex rhythmic	1	21	6	0
	3	16	10	1
	5	8	14	5
Spastic	1	15	12	0
	3	9	15	3
	5	10	16	1
Rolling	1	15	9	3
	3	7	14	6
	5	8	16	3
Propulsive	1	17	7	3
	3	12	15	0
	5	7	16	4
Hand Sucking	1	4	23	5
	3	6	8	23
	5	2	23	22

The numbers in the body of the table represent the total number of infants who showed the pattern in question to the degree indicated at the head of the column. Since twelve babies failed to maintain a state of mass activity for the required total of five minutes daily during each observation day, only 27 infants are represented in this analysis. All these met minimum requirements for duration of mass activity.

It will be seen that the patterns 'Co-ordinated movements' and 'Rhythmic movements' have been subdivided and presented respectively as 'Co-ordinated body' and 'Co-ordinated limb' movements and as 'Simple' and 'Complex' rhythmic movements. This was done because considerable difference is to be found in the number of infants who display these sub-types of activity on different days. Co-ordinated body movements, and complex rhythmic movements are slower to develop than co-ordinated limb and simple rhythmic movements.

From the table, the following tendencies can be observed. There is a general increase in most of the structured movements of mass activity from the first day to the fifth. These patterns are both shown by increasing numbers of infants, and also displayed more frequently by individuals as the babies grow older.

These tendencies are particularly marked in simple patterned and simple and complex rhythmic movements. These movements are respectively absent in 7, 8, and 21 infants on the first day, but in only 2, 1, and 8 on the fifth day. They are shown to a marked degree by 9, 7 and 0 infants respectively on

the first day and by 21, 24 and 5 children on the fifth. From these figures it seems likely that the complex pattern of rhythmic movements is relatively slow to develop, being absent in far more infants for a longer period and marked in only a handful on the fifth day.

Similar trends are seen in co-ordinated movements of the body and limbs. Body movements are absent in 23 infants on the first day, and in 14 on the fifth, and limb movements are absent in eight babies on the first day and one on the fifth. No infant shows co-ordinated body movements to a marked degree on the first day, but seven do on the fifth, and similarly with limb movements, five children display them markedly on the first and sixteen on the fifth.

Trends in propulsive and patterned movements are less clear, but they also seem to be shown by more infants as age increases.

The number of spastic movements seems to remain fairly constant from the first to the fifth day, but a slight apparent increase in this type of activity on the third day may support observations of a similar increase that seemed to occur during specific activity and sleep.

Hand sucking shows least change from day to day. It appears that most infants can get their fists into their mouths from the day they are born, and they carry out this activity with unabated frequency throughout their first week of post-natal life.

(c) Individual differences in mass activity patterns

Individual peculiarities are hidden in surveys which show the general direction of change in a group. Inspection of protocols indicates that not all babies follow the same general trends, and that some patterns are more likely than others to be modified in individual cases.

Co-ordinated movements seem to be particularly subject to variation. In this study approximately half the infants made stretching movements of their bodies and limbs during all activity states. Six made no co-ordinated movements of the body, though they stretched their limbs in all three states. Three more only made body movements during sleep and specific activity. One infant was never seen to make any co-ordinated movements of any sort at any time.

This was baby 13, the only infant in the group who had required resuscitation after birth. He was also the only baby who made no mass movements during the first day.

Simple rhythmic movements, as has been mentioned above, were present in the majority of babies from the first day of life. The complex form was, however, still absent in about one-third of the subjects on the fifth day. It was not shown by baby 13. Similar trends were found in the manifestation of propulsive movements. These too became more common as infants grew older and they were present in all but five subjects by the fifth day.

Similar variations may be present in other patterns, particularly the patterns of rhythmic movements. Whether or not this is so, the fact that some become more frequent with age suggests the operation of maturation factors at least. The case of baby 13 indicates that the relationship of complex motor behaviour to trauma during birth may be worth investigating. In general it seems likely that these patterns may be connected with the infant's state of health and maturity, and may be a reflection of differing stages and rates of maturation. Much more detailed and complete recording than was possible in this study is necessary if the significance of patterns occurring during mass movements is to be fully understood.

5. Results of Analysis of Data from Feeding Observation

(a) The feeding situation

Study of the behaviour and handling techniques of mothers and of signs of frustration in infants indicated that the bottle and breast feeding situations are by no means identical.

Survey of observer's comments relating to the mother's attitudes and personality and handling of the infant showed that the breast fed group received many more comments than the bottle fed one, and that a greater range of behaviour was described in this group. Of the comments that were made about the breast feeding situation, 67.5% referred to the attitudes and personalities of the mothers. Only 43% of the comments were similarly directed in the bottle feeding group.

The number of positively toned observer's comments far exceeded the number of negatively toned ones in both groups. Mothers who fed their children from a bottle, however, obtained nearly four positively toned comments on their personalities for every negatively toned one, and nearly three favourable remarks about the way they handled their infants for every unfavourable one. Mothers who breast fed their babies fared far less well. They received only twice as many positively as negatively toned comments on their personalities and attitudes, and not quite twice as many complimentary remarks about the ways in which they handled their infants.

Results of the count that was made of comments relating to difficulty in feeding and probable frustration of infants, showed that instances of frustration were more than three times as frequent in the breast fed as in the bottle fed group. In addition there were only two comments describing ease and comfort in this group for every three such remarks applied to bottle fed babies. These results seem to indicate that breast feeding, as experienced by the baby is more likely to be frustrating than bottle feeding.

These results probably point to the greater complexity and stronger potential for emotional involvement which is inherent in the breast feeding situation, rather than to any real differences between mothers who nurse their babies and those who do not. From a theoretical point of view, it would seem that if feeding is an important formative experience in the lives of young babies,

those infants who are breast fed are more likely to be exposed to both strong and varied pleasant, and strong and varied negative experiences. It would seem also that in the early stages at any rate, they are likely to be both less skillfully handled and less consistently loved.

Though no conclusions can be reached on the basis of this study in respect to the relative merits of breast and bottle feeding, it does seem that some hitherto unstressed variables may be more important than had been expected. Variety as well as nature of experience may play a part in determining infant development. From this study it would seem that breast fed babies are likely to be subjected to both a richer variety of emotional climates and also more experiences of frustration and discomfort.

(b) Behaviour states in bottle and breast fed infants

Study of the consistency of sleep and mass activity states revealed no stability in the ranking of either bottle or breast fed groups.

(d) Comparison of feeding times of bottle and breast fed groups

Results showed that the large majority of both breast and bottle fed infants completed their feedings with five to nine minutes. The average time taken by the breast fed group was, however, 10'58", and the average time taken by the bottle fed group was 8'41". Since, however, two breast fed babies were

permitted to remain on the breast for very long periods of time, this difference probably reflects distortion caused by extreme scores, rather than real differences. The distribution of feeding times in the two groups indicated that there was probably no real difference between breast and bottle fed infants with regard to the time needed for feeding.

6. Summary of Results

Study of motility during sleep and specific activity indicated that these two states could be differentiated on a numerical basis by the criteria proposed.

Investigation of the stability of rankings when infants are ordered according to the length of time that they spend in sleep or mass activity during the first, third and fifth days did not indicate any consistency in the amount of sleep or specific activity displayed by babies, nor do infants show consistent tendencies toward frequent or infrequent changes of behaviour state.

Exploration of the possibility that individual differences might be present in the numbers of movements that babies made during sleep and specific activity yielded results that were ambiguous.

No evidence of dominance by any particular part was found when segmental movements were analysed.

Analysis of movements that took place during mass activity revealed seven different patterns. Most of these were found to

increase in frequency from the first to the fifth days. There was some evidence that individual babies differ in the patterns that they display, but differences were marked in one infant only.

Classification of data from protocols and remarks made in feeding notes showed that greater variety of maternal behaviour was displayed when babies were breast fed. Mothers who nursed their babies obtained more negatively toned comments about their personalities, attitudes, and handling techniques, and their infants showed more signs of frustration.

No differences were found in the behaviour state characteristics of bottle and breast fed babies.

Time spent sucking was the same in both groups.

Chapter VI

CONCLUSIONS

In terms of differences in amount of movement, type of movement, and in proportion of body involved in the movements, we have defined three behaviour state categories: mass activity, sleep, and specific activity. These categories provide a useful basis for organizing and analyzing data obtained from observations of the spontaneous behaviour of human neonates.

Results presented in the previous chapters do not establish definitely the presence of significant behavioural differences among neonates. They show trends, however, which suggest that such differences might be revealed if certain forms of infant behaviour were subjected to fuller, more controlled examination.

From the fact that this study did not reveal consistent differences among infants in proneness to a particular behaviour state, frequency of change of behaviour state, and degrees of motility during sleep and specific activity states, it must be concluded either that infants do not differ in these respects, or that such differences could not be apparent under the circumstances of the present investigation. Apart from the possibility that our methods of recording and analysis may have been too crude to reveal them definitely, it may be that during the first week

of infant life individual differences are concealed as a result of certain types of influences. For example, it may be that individual behaviour patterns in neonates are disrupted by the birth experience or by the need for new modes of physiological adjustment; or, it may be that fleeting changes in the infant's internal equilibrium, or in conditions of light, noise, and temperature in the nursery play disproportionately large parts in stimulating the physical reaction of newborn babies. Investigation to assess these possibilities seems warranted.

The fact that differences were shown to some extent in the type of movement patterns during mass activity, and in the ages at which they became apparent suggests that newborn babies are not altogether alike.

The case of baby 13 is particularly interesting in this connection since this was the only child who needed resuscitation and was also the infant whose movement patterns were most deviant. Of course, no conclusions can be drawn from a single case, but the differences that were found in this infant support the idea that further study of infantile patterns of movement might yield valuable information about a child's health, maturity, and adjustment to post-natal life. Absence or distortions of commonly occurring patterns may reflect neurological damage which is not otherwise apparent until very much later.

Analysis of data about mothers and infants during feeding, suggests that this is another area that might be subjected to further study. It was not possible to reach conclusions about

the behaviour of individual babies, but study of the feeding situation as a whole revealed certain differences in the influences affecting breast and bottle fed babies which may have some significance in their later development. As compared with the bottle fed, breast fed infants are exposed to more varied emotional climates, more occasions of unskillful handling, and more occasions and feelings of frustration. These could influence the course of an infant's development and the formation of his personality, but the effects need not necessarily be unfavourable.

As a result of this study, it is concluded that there is some evidence of difference among young infants, but in normal neonates individual variations may be concealed to some extent during the first week of life by similarities in the common growth process. At that time also, the birth experience and exposure to new and varied stimulation from the physical environment may still be having an overriding effect on the behaviour of the infant. It is concluded also from this study that different feeding methods result in different emotional experiences which could have effects on the later development of the child.

CHAPTER VII

SUMMARY OF STUDY.

The purpose of the study was to investigate the first manifestations of variation in human beings. The objective was to describe differences that first appear and to clarify some of the dimensions and limits which form the background of such variations.

Since several sources testified that differences are present in young infants even during the first days of life, thirty-nine neonates were used as subjects. All were normal in the sense that, according to present medical knowledge, they were expected to develop into healthy children and adults.

These babies were observed in natural life situations. Observations were made of their behaviour while lying in their cots in the newborn nurseries, and while with their mothers, being fed. No particular activities were selected for study, but as detailed as possible a record was made of their spontaneous behaviour in these two situations.

Each baby was observed ten or eleven times during the first week of his life: eight times while in his cot and two or three times while being fed. Thirty minute observation periods were spaced throughout the 1st. 3rd. and 5th. days of

life in such a way that all infants would be within twelve hours of one another's age, and all would be studied at the same periods relative to their feeding cycles. All recordings were made in code by the same observer and careful notations were made of the times at which events occurred.

Data from cotside and feeding observations were analyzed in different ways and with different ends in view. On the basis of cotside data comparisons were made between individual infants, and criteria for assessing whether or not differences were present were defined as follows: variations, if constitutional, should be apparent over a period of time, and infants, if ranked or classified according to a given trait, should maintain their relative positions or categories from day to day. Conclusions, that were reached on the results of three types of analysis done on cotside data, made use of this definition.

The analyses were as follows:- first criteria which would differentiate between three types of behaviour state were defined in terms of the infant's level and type of motility. These states were named 'mass activity', 'sleep', and 'specific activity', and were suggested by the infants' behaviour during observations, by obvious differences in type and frequency of data, and by some findings of previous studies.

Infants were ranked according to the total amounts of time spent in sleep and mass activity, and a non-parametric

statistic, Tau, was used to see if there was any consistency in the orderings that was significant at the .05 level. This was not found to be the case, nor were infants found to be consistent in the frequency with which they changed from one state to another.

The analysis of behaviour states was followed by a study of the number of movements that infants displayed per three minute period during sleep and specific activity. It was, however found that neonates changed so rapidly from one state to another that a sufficient number of observations could not be obtained and results were ambiguous.

The movements of body segments such as the head, body, arms and legs, and extremities were totalled and infants were compared to see whether or not there were patterns of dominance among segments that differed from baby to baby. Results indicated no stable patterns.

The movements which occurred during mass activity were studied and seven structured patterns were found. Most of these tended to increase in number as the child grew older, and some differences were apparent in the types of pattern that were shown. The fact that the only infant who had required rescussitation was the most deviant with respect to mass activity patterns may mean that these patterns are bound up with an infant's post-natal health and adjustment.

Individual comparisons were not possible on the basis of data gained during observation of feeding. Breast and bottle fed groups of infants were therefore compared, and when material had been classified and sorted, it was found that breast fed babies were likely to be subjected to a wider range of maternal feeling, and to be less consistently skillful handling. They showed more feelings of frustration than bottle fed infants. No infants in either group showed significant inclinations toward sleep or mass activity.

On the basis of the results reported above, it was concluded that there is some evidence that individual difference exist in the patterns of mass activity, but on the whole similarities imposed by the growth process, or disturbances resulting from birth conceal individual variations in infants during the first days of life.

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APPENDIX A

COTSIDE OBSERVATION SHEET

BABY_____ DOCTOR_____

DATE OBSERVED_____ TIME_____ to_____

BORN_____ AGE_____

STATE

BEHAVIOUR STATES	ACTIVITIES	TIME	BEHAVIOUR STATES	ACTIVITIES	TIME

APPENDIX B

FEEDING OBSERVATIONS

BABY_____ DOCTOR_____

DATE_____ TIME_____to_____

BORN_____ AGE_____

STATE.

FEEDING

APPENDIX C

Specimen table of duration and sequence of Behaviour States

Infant 27

Period Before feeding

Day 3rd.

Sleep	Specific Activity	Mass Activity	Crying	Unclassified Activity
6.0	3.30	.50		
	2.30			.30
		3.0	2.0	
	1.0	4.30	3.30	
	.40	7.30	8.0	
6.0	7.40	15.50	13.30	.30

APPENDIX D

Specimen Tabulation of Activities during Specific Activity *

BABY - 27

PERIOD BEFORE FEEDING DAY 3rd

	General Flex. Ext.	General Loc.	Co-ord. Flex.	Co-ord. Ext.	M	Sp.	T.S.	G.I.	F.M. E.	F.M. F.	F.M. M.	Add.
Hd.	11	111					~~1111~~	1111	~~1111~~ ~~1111~~ 111	~~1111~~ 111	~~1111~~ ~~1111~~ ~~1111~~	Hd.5 F.36 G.I.9
B.			1		1							2
L.	~~1111~~ ~~1111~~ ~~1111~~ 11	~~1111~~ ~~1111~~ ~~1111~~	111	11		~~1111~~ 1111						45
E.	~~1111~~ ~~1111~~ 11	111				11						18
Add	31	21	4	2	1	11	5	4	13	8	15	115
Tot.	52		6		1	11	5	4	36			115

Abbreviations:

Hd. - Head
B. - Body
L. - Limbs
E. - Extremities
Add. - Addition
Tot. - Total
Flex. - Flexion
Ext. - Extension
Loc. - Change of Location
Co-ord. - Co-ordinated
M. - Moro movements
Sp. - Spastic movements
T.S. - Throat sounds
G.I. - Gastro Intestinal and Respiratory movements.
F.M. - Facial movements
E. - Eyes
F. - Face
M. - Mouth

*Movements during sleep would have been added in a different coloured ink.

APPENDIX E

Movement Patterns During Mass Activity.

		Sp.	Co-ord.		Pat.	Rhythmic		T.	Pr.	Su.	Time (mins.)
Baby	Day		B.	L.		S.	C.				
1	I	P		P	P						10.0
	III	-	-	-	-	-	-	-	-	-	-
	V	-	-	-	-	-	-	-	-	-	-
2	I	-	-	-	-	-	-	-	-	-	-
	III	-	-	-	-	-	-	-	-	-	-
	V	P		P	P	M		M		M	24.5
3	I				P						6.5
	III	P	P		M	M	P			M	60.0
	V	P	M			P		P		P	8.0
4	I				M	P		P	P	P	17.5
	III	P	M	P	M	M	P	P		M	34.0
	V		M	M	M	M			P	P	24.0
5	I			P	P					P	15.5
	III	P	M	M	P	M		P		P	22.0
	V			M	M	M	P			P	23.0
6	I	P		M	M	P		P		M	22.5
	III	P	M	M	M	M		P	P	M	49.5
	V		M	M	M	M	M	P	P	P	20.5
7	I	P		P				P			11.5
	III	M		M	P	M					13.0
	V	P			P	M	P	P	P	M	37.0
8	I			P	P					P	25.0
	III	P	P	P	M	M				P	28.6
	V	P		P	M	M	P			M	26.0

CODES - mean: baby did not show 5 minutes mass activity
P " Present
M " Marked

ABBREVIATIONS:
Sp. - Spastic
Co-ord. - Co-ordinated
Pat. - Patterned
T. - Turning
S. - Simple
C. - Complex
Pr. - Propulsive
Su. - Fist sucking

Movement Patterns During Mass Activity.

Baby	Day	Sp.	Co-ord. B.	Co-ord. L.	Pat.	Rhythmic S.	Rhythmic C.	T.	Pr.	Su.	Time (mins.)
9	I				P	P		P		P	9.0
	III	M	P	M	P	M		P		M	39.0
	V	-	-	-	-	-		-		-	-
10	I	P		P			P		P	P	12.5
	III			M	M	M	P	P		M	10.0
	V	P		M	M	M	M	P		M	38.5
11	I	P		M	M	M	P	M	P	M	34.5
	III			P	M	M		M		M	29.0
	V			M	M	P		M		M	21.0
12	I	P		M	P	M	P	M		P	15.0
	III	P	M	M	P	M	P	P	P	P	38.0
	V	P	M	M	M	M	P	P	M	M	45.0
13	I	-	-	-	-	-	-	-	-	-	0
	III	P			P	M		P		M	47.0
	V	P			P	M				M	53.0
14	I	-	-	-	-	-	-	-	-	-	-
	III	P		P	P	M		P		P	26.0
	V	P			P	M	M	P		M	42.5
15	I				P	P			P	M	10.5
	III	P	P	P	M	M	P	M	P	M	31.5
	V		P	M	M	M	P	P	P	M	43.0

CODES - mean: baby did not show 5 minutes mass activity
P " Present
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ABBREVIATIONS: Sp. - Spastic
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T. - Turning
S. - Simple
C. - Complex
Pr. - Propulsive
Su. - Fist Sucking

Movement Patterns During Mass Activity.

Baby	Day	Sp.	Co-ord. B.	Co-ord. L.	Pat.	Rhythmic. S.	Rhythmic. C.	T.	Pr.	Su.	Time (mins.)
16	I		P								8.0
	III		P	P	M	M		P	P	M	27.5
	V	P	M	P	P	M	P	P	P	M	23.0
17	I	P		P	P	P				P	27.0
	III	M	M	M	M	M		M		M	57.50
	V	P	P	P	P	P		P	P	P	16.5
18	I	P		P	M	P			M	P	10.0
	III	P	M	M	M	M	P	P	P	P	18.5
	V		P	M	M	M	M	P	P	P	38.0
19	I			P	M	P				M	21.0
	III		P	M	P				P		7.0
	V			M	M	M	P	P	P	M	26.0
20	I	-	-	-	-	-	-	-	-	-	-
	III	P		M	M	M		P	P	P	22.0
	V		P	P	M	M			P	M	27.5
21	I			P	M	P		P		P	9.5
	III	P		M	P	M	P		P	M	19.5
	V	P		P	M	M	P		M	M	71.0

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Movement Patterns During Mass Activity.

Baby	Day	Sp.	Co-ord. B.	Co-ord. L.	Pat.	Rhythmic. S.	Rhythmic. C.	T.	Pr.	Su.	Time (mins)
22	I	-	-	-	-	-	-	-	-	-	-
	III	P		P	P					P	17.5
	V	P			M	M		P	P	M	35.5
23	I		P			M		M		P	25.0
	III	P	M	P	M	M	P	M	P	M	49.0
	V	P	M	P	M	M	P	P	P	P	26.0
24	I	P		P	P					P	11.0
	III	P	P	P	M	M		P		M	35.0
	V		P	P	M	M		M	P	M	32.0
25	I	-	-	-	-	-		-	-	-	-
	III	P	P	P	P	M		P	P	M	17.5
	V		M	M	M	M		P	P	M	33.5
26	I		P	P	P	P					23.5
	III		P	M	M	M		P	P	P	27.0
	V	P		M	M	M	P	P	P	P	50.0
27	I	P			P	P				P	16.5
	III	P						P	P		13.0
	V			M		P	P		P		14.5
28	I			M	P	P		P	P	P	14.5
	III	M		P				M			11.5
	V	P		P	P	M		M		M	30.0
29	I			P	P	M	P	P	P		19.0
	III		P	M	P	P					10.0
	V	-	-	-	-	-	-	-	-		-

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Movement Patterns During Mass Activity.

		Sp.	Co-ord.		Pat.	Rhythmic.		T.	Pr.	Su.	Time (mins.)
Baby	Day		B.	L.		S.	C.				
30	I	M			M	P		P		P	29.5
	III	P				P			P		10.5
	V	P	P		M	M	P	P	M	P	37.5
31	I	P			P	M	P	P	P	M	20.0
	III	M				P				P	11.0
	V	P			M	M	P		P	P	46.0
32	I	P				P		P		P	10.5
	III				P	M		M	P	P	18.0
	V	P			P	M		P	P	M	8.5
33	I	P			P	M	P		M	P	17.0
	III				M	M	P	P	P	M	45.0
	V				M	M	M		P		60.0
34	I	-	-	-	-	-	-	-	-	-	-
	III	P			P	M				P	24.5
	V	P	P		M	M			P	M	24.0
35	I	-	-	-	-	-	-	-	-	-	-
	III	P	P	P	P	M			M	M	41.0
	V			P	P	M		P	M	P	9.0

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Movement Patterns During Mass Activity.

		Sp.	Co-ord.		Pat. Rhythmic.		T.	Pr.	Su.	Time (mins.)
Baby	Day		B.	L.		S. C.				
36	I	-	-	-	-	- -	-	-	-	-
	III	P	P	M	M	P	P		M	44.5
	V		M	M	M	M	P	P	M	50.0
37	I		P	P	M	M	P	M	P	43.5
	III		P	P	M	M M				57.0
	V		M	P	P	M M	P	M	M	27.5
38	I				P	P			P	8.0
	III			M	P	M	P	P	P	27.5
	V	P		M	M	M	M		P	33.0
39	I				M	M P		P	P	21.5
	III		P	M	M	M P	P	P	M	53.5
	V			P	M	M P	P	P	P	38.0

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