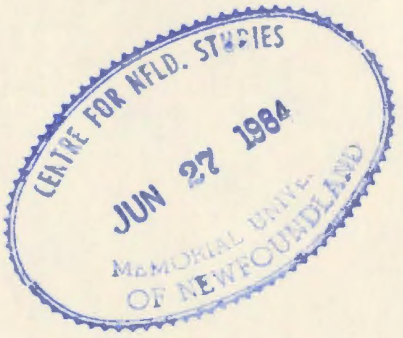
INITATION OF INFANT BEHAVIOUR AND INFANT RESPONSE

MARY LORNA BERNDT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IMITATION OF INFANT BEHAVIOUR

AND INFANT RESPONSE

by

Lorna Berndt, B.A.(Hons.)

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Abstract

Twelve infants were videotaped during a play session with a female experimenter, in which the experimenter alternately imitated all the infants' actions, smiles, and vocalizations, imitated only smiles, and imitated none of the infants' behaviours. It was found that infants were significantly more likely to repeat an action or vocalization when the adult imitated it, but were not more likely to repeat a smile when this was imitated by the adult.

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Adult-infant interaction consists of responses made by both the adult and the infant to each other. There is no doubt that these responses are made, and that adults, in particular, behave in certain ways so as to facilitate such interaction. Goldberg (1979) and Stern (1974) described some of these behavioural changes. Adults tend to speak more slowly, repeat their words often, exaggerate articulation and inflection, and speak in a more highly-pitched voice. These characteristics of speech are the ones to which infants are most sensitive. Also, adults not only exaggerate their facial expressions, but face infants from a particular distance (17-22 cm), which is the range at which newborns can best focus on objects. By altering their behaviour in these ways, adults increase the likelihood that the baby will perceive the stimulation they provide.

Especially interesting is the observation that adults typically "pace their behaviour according to the infant's pattern of waxing and waning attention" (Goldberg, 1979, p. 215); that is, adults initiate play or respond to the infant, depending partially on whether the baby is attending to them. This means that babies can control the amount of behaviour directed to them by selectively paying attention. The effects of being able to exert control on

various events will be discussed later. At this point, it is important to recognize the degree to which adults and babies respond to each other.

Evidence of responsiveness on the part of both adult and infant is found in a study by Condon and Sander (1974), in which it was seen that both engaged in 'interactional synchrony', previously observed between adults. Interactional synchrony consists of the speaker making particular body movements that correspond to his speech, while the listener makes certain motions as he listens. In this study, neonates changed their body movements in response to the adult's speech, demonstrating sensitivity to minute portions of speech and an ability to respond differentially to these portions.

To summarize thus far, babies and adults respond to each other in a number of ways, and the subtle adjustments in behaviour made by both indicate the extent of mutual responsiveness in adult-infant interaction.

The importance of this responsiveness is apparent when, for some reason, it is perceived by either the adult or infant as failing to occur in their relationship. For example, mothers often report that they enjoy interacting with their infants much more once the baby begins to make eye contact with them (Robson, 1967). By some

mothers, if not most, eye contact would seem to be perceived as a form of infant responsiveness which indicates that the infant is aware of them and interested in interaction. Thus, it is important to mothers that their infants respond to them in this particular manner.

Blind babies cannot make this response. Also, according to Fraiberg (1974), they smile less frequently than do sighted babies, do not necessarily smile in response to social stimuli, and display a restricted range of facial expression. Mothers of blind babies perceive their babies as being unhappy or sad, possibly because they do not smile as do normal babies. Furthermore, the babies' limited repertoire of behaviour, as well as the absence of eye contact, would seem to be responsible for mothers' observations that their babies are 'uninterested' in play. It appears that when babies do not respond with the behaviours expected by the adult, they are perceived as being unwilling to engage in interaction.

Eye contact is important not only to adults, but to babies as well. In one study (Bloom, 1974), adults wore different types of spectacles; with opaque or clear lenses, or with photographs of gaze-averted or directly-gazing eyes glued onto the lenses, and provided a touch,

smile, and sound for each infant vocalization. The reinforcement was not effective unless the baby saw eyes (whether photographed or real).

Papousek and Papousek (1974) showed infants either televised images of themselves or live TV images and had the images either making eye contact with the infant or not. At the age of five months, infants preferred to look at the image which made eye contact, even if it was a TV image (previously recorded). Thus, it seems that eye contact is an important part of interpersonal interaction, not only to adults, as noted earlier, but to babies as well.

However, in some situations, eye contact is apparently inadequate as a sole means of social interaction. When adults were asked to look at infants, but make no response to them, infants were reported to begin fussing and crying (Brackbill, 1958; Rheingold, Gewirtz, & Ross, 1959). Although the effect has not been widely reported, it does demonstrate that adult-infant relationships may not be satisfying to the baby when the adult makes no other response to his/her behaviour, even though there is an opportunity to maintain eye contact with the adult.

In summary, it appears that adults and infants do

respond to each other when engaged in various types of interaction and that there are strong reactions when one member of the pair fails to make what the other member considers to be adequate response.

Maternal Responsiveness

The major concern of this paper is with adults' responsiveness to infants. Much of the research on this topic has centered on maternal responsiveness and has investigated its effects on measures of the infants' attachment behaviour, responsiveness, cognitive development, responses to Bayley Index items, and exploratory behaviour. In general, such research has found mother-responsiveness to be related to desirable infant behaviour along these dimensions.

Osofsky (1976) studied mothers and their 2- to 4-day-old infants during bottle-feeding and during a session in which the mothers presented various items (rattles, balls, etc.) to the babies. In these situations, mothers were rated on attentiveness, general sensitivity, frequency and quality of auditory, visual, and tactile stimulation. In general, it was found that the more responsive infants (in both situations) had mothers who were typically sensitive to their behaviour.

Yarrow, Rubenstein, Pedersen, and Jankowski (1972)

measured the amount and quality of social stimulation mothers gave their infants (talking, smiling, touching, contingency of behaviour, positive affect). Infants were scored on the Bayley Index items dealing with exploratory behaviour and preference for novel stimuli. Contingent maternal responses to distress were related to higher scores on the Bayley Mental Development Index and to measures of goal-directed behaviour. The degree of intensity, number of changes in play, and expression of positive affect from the mother were related to the infant's social responsiveness.

Clarke-Stewart (1973) studied babies from birth to 8-10 months of age, and rated mothers in terms of 'optimal maternal care'. This item measured responsiveness to the infant's social demands, spending time with the baby, playful interaction, eye-to-eye contact, and the variety of toys provided. The baby's level of competence was measured by his expression of emotion and his performance on the Bayley Index. A strong relationship was found between 'optimal maternal qualities' and a high level of infant competence. In particular, verbal stimulation was closely related to competence, but not when it was non-responsive stimulation. That is, only maternal speech in response

to the baby's behaviour was strongly related to infant competence.

Contingent responsiveness has been related to sensorimotor performance in a study by Beckwith, Cohen, Kopp, Parmelee, and Marcy (1976). Interaction between mother and baby was monitored when the baby was 1, 3, 8, and 9 months old, as was the baby's performance on the Gesell developmental schedules. Skillful sensorimotor performance at nine months was related to mutual gazing at one month, smiling during mutual gazing and contingent response to fuss cries at three months, and contingent response to non-distress vocalizations at eight months.

Another type of responsiveness was examined by Blehar, Lieberman, and Ainsworth (1977). They measured the degree to which the mother 'paced' her behaviour contingently on that of the baby. Contingent pacing was defined as the "percentage of episodes in which (the mother) paced interventions slowly and gently, modifying them in keeping with the infant cues, pausing if needed to allow him time to make response" (Blehar, Lieberman, & Ainsworth, 1977, p. 185). For example, a responsive mother would be expected to react to her baby's smiling, vocalizing, bouncing, and fussing. Infants' behaviour in the Ainsworth "Strange Situation" was recorded and classified as being indicative of either anxious or

secure attachment. It was found that mothers of securely attached babies were more often contingent in pacing the interaction and were more adept at prolonging interaction. Mothers of babies judged to be anxiously attached were more likely to initiate en face interaction with a silent, impassive face and less likely to respond to the babies' attempts to interact.

These studies are correlational in nature. Therefore, it can not be assumed that mothers' responsiveness was a factor in aiding the development of infant responsiveness, attachment, or competence. Possibly, mothers are more responsive to infants who are responsive, securely attached, and 'competent'. While these studies are inconclusive about the effects of mother-responsiveness to infant behaviour, the relationships found indicate that further study of mother-responsiveness is required.

Imitation

Mothers have been observed to imitate their infants during both play and caretaking sessions. Moss (1967) found that mothers imitated their infants at three months significantly more than they did at three weeks, although the rate he reported is not high (6.5 times per 8-hour session). Pawlby (1977) videotaped mothers and

their infants in play sessions. Out of 1651 imitative sequences, 79% were identified as mother imitating infant while the remaining sequences (21%) were infants imitating their mothers. O'Toole and Dubin (1968) observed mothers spoon-feeding 3- to 12-month-old babies and counted the frequencies of both mothers' and babies' mouth-openings. Out of 595 mouth-openings, the mother opened her mouth after the baby did 313 times or 52% of the time. Taken together, the above studies indicate that mothers' imitation of their infants comes to be a common form of mother-infant interaction.

The effects of being imitated are fairly consistent in some respects. In a study by Thelen, Dollinger, and Roberts (1975), grade 1 children were either imitated or not imitated on two simple tasks (drawing and choosing names). Children who were imitated were more attracted to the experimenter than were children who were not imitated. Furthermore, they were more likely to imitate the experimenter later in the session. Kauffman, Kneedler, Gamache, Hallahan, and Ball (1977) found similar effects with children performing a marble-dropping task. Not only is the imitator more attractive to the person he imitates, but that person is more likely to imitate him in response.

When children imitate their imitator, then they are essentially performing their own original behaviours. If they are more likely to imitate their imitator, then one would expect that the frequency with which they perform the behaviour which was imitated would increase. This expectation is supported by several studies. In one (Parton & Priefert, 1975), children were imitated if they made certain choices of stimuli. These stimuli came to be chosen more often than were others. Fouts (1975; Fouts, Waldner, & Watson, 1976) had children perform a marble-dropping task. When the child dropped his/her marble into a particular hole, the experimenter imitated that choice. In both studies, at the end of a session, children were more likely to drop a marble into the hole that was imitated by the experimenter. Again, a behaviour (dropping marbles into a particular hole) increased in frequency as a result of its being imitated.

Haugan and McIntire (1972) compared various types of reinforcement (vocal imitation, tactile stimulation, and food) for 3- to 6-month-old infants' vocalizations. Any sounds made by the infant were immediately repeated by the experimenter as accurately as possible. Such reinforcement was found to be more effective than tactile stimulation or food in increasing the frequency of infant

vocalizations. Imitation of an infant's behaviour resulted in an increase in the incidence of that behaviour.

The authors suggested that adult vocal imitation may have so affected infant vocalization because it changed as the infant's vocalizations changed, providing a greater variety of reinforcement. Variety itself, they feel, may have been a crucial part of the reinforcement. It is true that the adult's vocal behaviour varied, but this was not done at random. The variations made were in response to changes in the infant's vocalizations, therefore the adult's behaviour could be predictably altered with respect to its form and its time of occurrence.

Controlling the occurrence of events has been considered by several researchers to be reinforcing in itself (Leuba & Friedlander, 1968; Rheingold, 1963; Rovee & Fagan, 1976; Solkoff & Cotton, 1975; Vietze, Friedman, & Foster, 1974; Watson, 1967, 1972; Watson & Ramey, 1972; White, 1959; Zelazo, 1971, 1972). In these studies, infants could perform certain behaviours which always had a particular outcome, often a nonsocial one (e.g. a footkick always resulted in movement of a mobile). Results have been consistent in that the frequency with

which these behaviours occurred increased when such reinforcers were available, indicating that contingent events are reinforcing.

Furthermore, the study by Fouts et. al. (1976) suggests that the imitation situation is reinforcing not only because the response is contingent, but because it is similar to the child's behaviour. In this study, the experimenter dropped marbles either into the same hole as did the child, or into one of two other possible holes, but did so contingently on the child's action. Imitation led to a level of response (dropping marbles into the imitated hole) which was above chance, whereas counter-imitation led to below-chance response. This would indicate that having someone behave the same as the child was more reinforcing to the child than having them behave in a different way, even though both of the experimenter's behaviours were under the child's control. Although this study was done with older children and therefore cannot predict or explain infant behaviour in a similar situation, it is interesting in the context of this paper that imitation of actions was found to reinforce those actions.

In the imitation situation, the infant can control not only the occurrence of someone's response, but the

type of response he/she receives as well (and this response is similar to his/her own behaviour). This amounts to the infant having a substantial degree of control over events, a situation which has been seen to be reinforcing in that the behaviour which results in such control increases in frequency.

Imitation can be seen as a special case of the general 'control of events' type of situation. As such, it is expected that behaviours which result in imitation would increase in frequency, an effect which has already been demonstrated.

Smiling

Studies in which infants control various social and nonsocial events have found that infants typically laughed and smiled in such situations (Gunnar-Vongnechten, 1978; Wahler, 1967; Watson, 1972; Watson & Ramey, 1972). With respect to the imitation situation, several researchers (Field, 1977; Pawlby, 1977) have observed that when mothers imitated their infants, there was marked smiling and laughing on the part of the infants. Situations in which one can control events (and imitation is one such situation) seem to elicit smiling from infants.

Studies of the development of self-recognition have

observed babies in front of mirrors. Such research is pertinent because, in that situation, the baby in the mirror is a simultaneous imitator of the baby's movements.

Prior to five months of age, infants generally respond to their mirror images with increased attention and are particularly interested in seeing their mothers in the mirror (Amsterdam, 1972; Dixon, 1957).

At five or six months of age, the baby is 'sociable' toward his/her image (Amsterdam, 1972; Bayley, 1969; Dixon, 1957). The baby smiles at his/her reflection, makes contact with the image, and vocalizes. Both Dixon and Amsterdam describe the baby as appearing to treat the image as another infant or playmate.

As mentioned above, Papousek and Papousek (1974) found that five-month-old infants preferred a film of themselves that made eye contact with them, over a televised mirror image that did not. This would indicate the extent to which eye contact is important to infants at this age. However, the authors also reported a significant trend in the babies' behaviour over the course of the experiment; the babies showed increasing interest in the relation between their behaviour and that of their mirror image. For example, some babies

watched themselves closely in the mirror while repeatedly waving their arms. The authors concluded that, at approximately five months, contingency is in the process of becoming more important to infants.

This trend was noted by Bayley (1969) and Dixon (1957), although they report this type of contingency awareness as occurring somewhat later. Bayley has established the age of 6.2 months as a norm for playful response to the mirror; e.g. laughing, patting, banging, playful reaching, leaning toward the image, etc. In Dixon's study, infants of six or seven months of age characteristically engaged in repetitive activity while observing their mirror image, (e.g. opening and closing the mouth 'with deliberation', rising up and down slowly, reaching out and patting the image).

Of particular interest in the context of this paper are the smiling responses of the five-month-old babies. Their smiling, laughing, vocalizing, and reaching out are all behaviours which might be equally as likely to be displayed towards another infant as to the image of an infant in the mirror (themselves), regardless of whether that infant were to behave contingently or not.

On the other hand, such behaviour in the mirror situation may indicate delight at recognizing the

contingency of the image's movements on their own actions. Whereas this may have been cause for increased attention at an earlier age, it may, at five months, elicit smiling. This interpretation seems to be particularly plausible since older infants (6-8 months) demonstrate awareness of the contingent aspect of the image through more playful activity, movement, and observation of their own actions. Possibly, the infant becomes increasingly more involved with the contingency of the image's behaviour, beginning by intently observing, then expressing delight, and finally, by apparently purposely changing the image.

Such behaviour is certainly open to a large number of interpretations. However, reports of the smiling response to an imitative mirror image, typical of the 5- to 6-month-old, are consistent with Pawlby's (1977) and Field's (1977) observations that an adult's imitation of the infant's behaviour is related to the infant's smiling. Infants of this age may smile more when their behaviours are imitated.

An important point in relation to infants' smiling in imitation situations is that infant smiles are among those behaviours imitated. Under the conditions in Pawlby's and Field's studies, the mother was required to imitate smiles as one of the infant's behaviours. In mirror situations, the baby sees his/her smile imitated immediately. This

raises the possibility that the observed smiling rates in imitation situations were related to the imitator imitating the infant's smiles, as opposed to imitating all the infant's behaviours.

The studies previously reported on the effects of imitating infants' and children's behaviours consistently showed that doing so increased the frequency with which those behaviours occurred. It is thus possible that imitating infant smiles may lead to an increase in infant smiling just as other behaviours have been shown to increase when they have been imitated.

Some support for this idea comes from studies in which smiling was increased through the application of contingent social events (Brackbill, 1958; Brossard & Gouin-Decarie, 1968; Etzel & Gewirtz, 1967; Macdonald & Silverman, 1978; Roedell & Slaby, 1977; Tautermannova, 1973; Wahler, 1967; Zelazo, 1971). These studies demonstrated that smiling as an operant behaviour could be reinforced by a smile, light touch, and some sort of vocalization. This means that each of the infant's smiles was followed immediately by this combination of social events from the mother or experimenter. Since the combination included a smile, the nature of the reinforcement was such that the infant's smiles were actually

being imitated. Each infant smile was always followed by an adult smile. In these studies, the increase in smiling could be at least partially attributed to the fact that smiling was imitated by the adults. Thus, in imitation situations, infants may smile more than they usually do simply because their smiles are imitated.

Summary

Infants sometimes smile when they are imitated, but what accounts for this smiling? Imitation is a situation in which an infant can exert control over events, and controlling a situation has been known to elicit smiling and laughter in infants. Infants may smile when they are being imitated simply because they are exerting control over events. If so, imitation of any of an infant's behaviours should result in smiling. If smiling were not imitated, but other behaviours were, the smiling frequency should still increase.

Too, imitation of a behaviour has been shown to be related to significant increases in the frequency of that behaviour. Imitating any of an infant's behaviours should result in an increase in that particular behaviour. If smiles are imitated, their frequency should increase.

The question is: Do infants smile more when any of their behaviours are imitated? or do they smile more when only their smiles are imitated?

If the former is true, infants in a situation in which all their behaviours are imitated should smile and laugh more than when only one behaviour is imitated (e.g. smiling). On the other hand, if the latter is true, then infants would not smile when their behaviour is imitated, unless that behaviour is a smile. A further matter to be considered is the effect of imitating behaviours other than smiling (e.g. vocalizations, mouth movements, facial expressions) on the frequencies of those behaviours. If imitation of a behaviour reinforces its occurrence, then an increase in the frequency of reinforced behaviours can be expected. The frequency of occurrence of behaviours other than smiling should be observed in order to determine if this effect is specific to smiling or whether it occurs with respect to all the behaviours under study.

To investigate these questions, it was decided to place infants in situations which varied as to which of their behaviours were to be imitated by their mothers. Three situations were determined: (1) imitating only the baby's smiles, (2) imitating any behaviours except smiling, and (3) looking at the baby but making no response to him/her. Each situation lasted for 30 seconds. The first two situations occurred twice and the third situation occurred four times.

The main difficulty encountered in the pilot study was in carrying out situation (2). Mothers found it nearly impossible to refrain from imitating their infants' smiles. A second problem was that of extensive infant fussing, which was either due to the lack of mother's response in situation (3) or to being placed in infant car safety seats, which some mothers indicated were not conducive to typical play sessions.

To avoid these problems in Experiment 1, mothers were asked to establish an ongoing play session in which they alternately (1) played with the baby but avoided imitating any behaviour, (2) imitated only smiles during play, and (3) imitated all behaviours including smiling.

If infants smiled in the imitation situation mainly because their behaviours were imitated, more smiling would be expected in situation (3) than in situation (2), and more in situation (2) than in situation (1). In situation (3), more behaviours would be imitated (smiles included) than in situation (2) or situation (1), and more behaviour would be imitated in situation (2) than in situation (1). If infants smile in the imitation situation primarily because their smiles are imitated, and control of the situation is not the main reinforcing factor, then they would be expected to smile most in situations (2) and (3).

Again, it was found that babies fussed extensively during taping, indicating that the car seat may not have been a desirable position for this type of play. Mothers' comments were to the effect that a changing table might provide a setting more conducive to play. Furthermore, from the mothers' behaviour during taping, it was clear that they understood the purpose of the session was to elicit smiles, rather than vary contingencies. Because of the problems encountered in Experiment 1, the data collected was not used for analysis and methodological changes were made in Experiment 2.

In Experiment 2, babies were placed on a changing table and mothers were carefully briefed as to the importance of simply playing with their babies and following the imitation instructions for each situation.

The effects of these changes were more encouraging. Infants fussed much less on the changing table than they had in the car seats. However, they were still inattentive to the interaction attempted by their mothers, seeming to prefer looking at various objects in the room and at the experimenter.

It was thought that infants might pay more attention to the play session if the experimenter were to carry out the instructions. A novel person might be expected to

command more attention than would novel objects. The study, therefore, does not deal completely with mother-infant interaction, but with interactions between infants and a particular female adult. It is assumed that the experimenter engaged in normal adult-infant play, and that an adult's imitation of the baby would still be worthy of study.

A second change involved allowing mothers to choose the play setting for their infants, since there were still a few infants who had fussed on the changing table. The pilot study and Experiments 1 and 2 together suggested that none of the positions so far used was ideal for all babies. It was thought that providing options would result in a more appropriate play setting for each baby in Experiment 3.

Method

Pilot Study

The purpose of the study was to determine whether infants smiled more (in terms of both frequency and duration) when only their smiling was imitated, or when any of their behaviour was imitated. To this end, three play situations were devised:

(1) Mother was to look steadily at the baby, but make no response to him/her. (Control situation)

(2) Mother was to imitate only the baby's smiles, but was not to otherwise play with the baby.

(3) Mother was to imitate any of the baby's behaviour except smiling and was not to otherwise play with the baby.

It was hoped to compare the baby's smiling in situations (2) and (3), using (1) as a baseline. In (3), mothers were asked not to imitate smiling, because a measure of smiling in response to imitation of behaviour other than smiling was desired; that is, would infants smile when imitated, even if smiles were not imitated? Thus, the imitation of smiling would be removed as a confounding factor in eliciting smiles in the imitation situation.

There were two problems associated with these conditions. First, mothers found it extremely difficult to refrain from smiling when their infants smiled in situation (3), since they could imitate all other behaviours except smiling. Essentially, the situation as described above could not be achieved. Second, during situation (1) especially, infants often became fussy, seemingly because the mother made no responses to them at all. It appeared that this situation did not constitute a baseline of infants' behaviour under usual conditions,

perhaps because it was somewhat aversive to the infants.

Bloom (1979) commented that a baseline situation of staring unresponsively at an infant has been typically found to inhibit infant vocalizations. Apparently, this is an unusual situation for the infant and reduces the likelihood of vocalization occurring. It is possible that a similar effect occurred during situation (1) in this experiment so that infants tended to fuss rather than smile and play.

To deal with these problems, two changes were made. The first was to ask mothers to play with their babies throughout all three situations, so that a normal play session would be in progress. At the same time, they were to follow instructions to imitate or not imitate the baby, incorporating this behaviour into their play with the baby. It was hoped that this change would help to reduce fussing and produce more pleasant patterns of mother-infant behaviour.

The second change made was to eliminate the restriction in situation (3); that mothers refrain from imitating their infants' smiles. Instead, mothers were asked to simply imitate all of their infants' behaviours, including smiling.

Experiment 1

Subjects. Subjects were seven male and six female babies between four and eight months of age, recruited through an advertisement placed in a local newspaper. Mothers were offered $6.00 for their participation, and made appointments for a time of day when they judged that their infants would be "alert and ready to play".

Equipment. Videotaping was done in a large (4.8m X 4.5m) room (see Figure 1) with a counter which ran the length of one long wall, a blackboard between two doors on the opposite wall, a large table against a third wall and another larger (.9m X 1.8m) table positioned diagonally in the centre of the room. The counter held a 19" TV monitor, a SONY videocassette recorder VO-2600, a PANASONIC Mini-Wiper WJ-530 at one end (out of the baby's view), and a Shibaden TV camera FP-100 at the other end. There were no windows. Four evenly-spaced ceiling fixtures (two 60-watt bulbs in each) provided lighting.

Shibaden FP-100 cameras were located in two diagonally-opposed corners of the room, so that they faced each other across the centre table. One camera, placed on the counter, recorded the baby from a distance of two metres. The mother was recorded by the other camera set on a tripod 2.9 metres away. The PANASONIC Mini-Wiper

(special effects generator) enabled the images from the two cameras (mother and baby) to be displayed on the monitor side by side ("split-screen").

Infants were placed in a General Motors Infant Safety Carrier car seat (63.5cm X 38.1cm X 50.8cm) on the centre table and mothers sat on a stool 73.7cm high in front of the table, facing their infants from a distance of 50-75cm. A microphone, wrapped in foam rubber and placed beside the baby's seat, recorded the audio portion.

Throughout the play session, the mother received tape-recorded instructions through a small earphone. The tape recorder was placed on a chair behind the infant. The experimenter could hear the recorded instructions on a second earphone, and could stop the tape after each instruction was given, thereby controlling the length of each session. For this study, the length of these sessions was varied in order to determine whether there was an optimal length of session.

Procedure. Mothers brought their babies to the laboratory upon arrival at the university. While the cameras were being adjusted, the experimenter played with the infant and talked to the mother. Mothers were given a release form to sign and the experimenter noted the

baby's birthdate, sex, and birth order.

The experimental situation was then explained to the mother in the following way:

> We would like to videotape you and your baby as you play together for several minutes. While you play with your baby as you normally would, we will ask you to do three different kinds of things, each of them more than once.
>
> THE THREE THINGS:
>
> 1. We will ask you to continue playing with your baby, but try not to imitate anything your baby does.
> 2. We will ask you to continue playing with your baby, and at the same time, try to imitate everything he/she does.
> 3. The third situation is to continue playing with your baby, and try to make him/her smile once. Then, once your baby has smiled, keep playing with him/her but don't smile unless he/she smiles. The idea here is to imitate your baby's smiling only.
>
> As you play with your baby, we will ask

you to change smoothly from one situation to another. Each situation will be repeated. This will seem like one long play session to your baby, but you will be changing some of your behaviour as you hear the signals through an earphone.

There were three types of situation, the "not imitate" situation being a baseline or comparison situation (1). This situation always occurred before each of the other situations, as shown in Table 1. The other two situations (2 and 3) were each given twice, and could therefore occur in six different orders. Each infant experienced one of these orders of occurrence, with the baseline situation occurring before situations (2) and (3).

Insert Table 1 about here

When the mother indicated that she understood the instructions, taping commenced. Mothers were asked to establish eye contact with their babies and to say aloud when they had done so. This provided a criterion by which to judge future incidence of eye contact.

At this point, the first instruction was played to

the mother and the lens on the camera recording the mother was covered briefly to indicate on videotape than an instruction had been given. After approximately thirty seconds, the next instruction was given, and the camera lens was again covered. This continued until all eight instructions had been given.

After taping, the experimenter spent some time with the mother and baby, and usually showed the videotape to the mother. The mother was then thanked and paid.

Problems. The main problem associated with this attempt was extensive fussing on the part of the infants, as in the pilot study. Out of 13 babies, videotapes of two babies were incomplete due to crying, seven babies fussed for 30 consecutive seconds or began to cry during the latter situations (two of these babies had to stop for a short break), and of the remaining four babies who did not fuss extensively, three paid little attention to their mother (i.e. the mother had to re-focus the baby's attention five times or more). The mean number of smiles for the 11 videotaped babies were 20.5 during 'don't imitate' situations, 27 during 'imitate smiles' situations, and 13 during 'imitate everything' situations.

When questioned, several mothers thought that the babies simply did not like the car seat, possibly because

it was restrictive of their movements. Some mentioned that their babies were rarely playful when sitting up (e.g. during feeding or in car seats). Many said that their babies were particularly playful while being changed, and suggested this position as a possible alternative to the car seat. Thus, a changing table was used in Experiment 2.

Errors made by the mothers in carrying out the instructions were counted directly from the videotapes by one observer on two separate occasions, with an intra-observer reliability of .97 (Pearson Product Moment Correlation coefficient).

The eleven videotaped mothers made 24.5 errors altogether. These errors were distributed as shown in Table 2. According to these data, mothers made relatively

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Insert Table 2 about here

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few errors overall. However, some mothers' behaviour during the non-imitation situation gave the impression that the mothers were smiling throughout the situation, thereby imitating the babies' smiles. Babies smiled a total of 41 times during that situation, and mothers imitated 36% of these smiles (15 errors).

Preliminary smiling and imitation data indicate that mothers whose babies smiled five times or more were less likely to imitate the smiles, whereas mothers whose babies did not smile at all or smiled fewer than five times in the non-imitation situation were more likely to incorrectly imitate smiles. It is possible that the impression of mothers smiling throughout the play session was made by those mothers whose babies smiled infrequently or not at all.

Judging from comments made, some mothers thought that the objective of the session was to elicit smiles from their babies. A mother whose baby was smiling infrequently would be likely to smile more often and respond to the infant's smiles in an effort to elicit smiles.

Thus, in Experiment 2, the concept of simply playing with the baby was stressed, and more attention was focused on familiarizing mothers with the demands of the situation and providing them with some preliminary practice in meeting these demands while maintaining a playful atmosphere.

Experiment 2

Subjects. Subjects were seven female and seven male babies, between four and seven months of age, some of

whom had participated in Experiment 1.

Equipment. Videotaping was conducted in the same room as was Experiment 1 (see Figure 2). The large table in the centre of the room was placed against a wall and replaced by a vinyl-covered changing table (85cm X 46cm X 87cm).

Shibaden FP-100 cameras were located on two opposite sides of the room, so that they both focused on the changing table in the centre. One camera was set on a tripod on top of a large table (1.8m X .9m) and filmed the baby's face from a distance of two metres. The mother's face was filmed by a camera set on the other table approximately two metres away. Brown paper was hung from the ceiling in front of the large table in order to conceal the camera and tripod, and a small hole was cut for the lens. The PANASONIC Mini-Wiper (special effects generator) enabled the images of the mother and baby to be displayed on the monitor side by side ("split-screen").

Infants were placed on the changing table and mothers stood at the foot of the table, facing their infants from a distance of approximately 50 cm. A microphone, wrapped in foam rubber and placed on a stool 74 cm high at the head of the changing table, recorded the audio portion.

As in Experiment 1, mothers were given tape-recorded instructions through a small earphone.

Procedure. The procedure in Experiment 2 was essentially the same as in Experiment 1, the only difference being in the extent to which mothers were trained in carrying out the situations.

First, mothers read a typewritten version of the instructions given in Experiment 1. The experimenter then verbally explained each situation and answered any questions. A brief demonstration of the tape-recorded instructions followed, and finally, mothers practised the situations with their infants prior to actual video-taping.

Very little scorable data were obtained during Experiment 2. Infants still tended to become fussy on the changing table, although this situation resulted in less prolonged fussing than in the car seat situation. The data in Table 3 compare Experiment 1 (car seat) with Experiment 2 (changing table) in this regard.

Insert Table 3 about here

The data show that while there was less fussing and crying during Experiment 2, there was no increase in the

babies' interest in the session, judging by the number of babies whose attention had to be refocused often. However, the frequency of infant smiling increased very slightly in Experiment 2, as shown in Table 4. Although

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Insert Table 4 about here

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infant smiling increased slightly, and fussing and crying decreased, the number of babies whose attention had to be refocused quite often indicated that the changing table situation was still not a typical play session.

Mothers were less able to explain why infants may not have been very attentive under the conditions in Experiment 2. Some mothers suggested placing the infant on the floor, saying that they often played on the floor at home. This would allow for more flexibility of movement, so that each baby could assume his/her most comfortable and familiar position and also be able to move more freely. Thus, it was decided that mothers be given a choice of situations in the next experiment - being able to place the baby in the car seat, on the changing table, on the floor, or on their laps. It was hoped that such flexibility would create a more familiar play session and maximize the chance of the infant's

remaining in a playful mood.

Another comment offered by some mothers was that the baby was interested in the novel items in the room, such as camera equipment. Although these were mainly placed out of the infant's visual range and brown paper hid the equipment which could not be moved, infants still twisted and looked behind them quite frequently (resulting in the mothers' having to refocus the babies' attention). Mothers thought that their babies wanted to see the novel objects in the room and that they themselves were less interesting to the baby at that time because of the room's novelty. During videotaping, comments to the baby while engaging in attention-getting devices (turning the baby's head, snapping fingers, talking to the baby) included, "Oh, you don't want to look at mom, do you? You want to look at all those things over there." It seemed reasonable to suppose that a novel person would capture attention even more than would novel surroundings, as long as the mother remained nearby.

Overall, fewer errors were made in carrying out the instructions in Experiment 2, as indicated in Table 5. Tapes were scored for errors as in Experiment 1 and the intra-observer reliability was .99.

In Table 5, it can be seen that there was a decrease

in the frequency of each type of error, with the exception of 'failing to imitate behaviour'. The errors of this type more than doubled in frequency and seem to be mainly attributable to the behaviour of two mothers, each of whom failed to imitate four or more behaviours. Five other mothers failed to imitate only one behaviour and four had no failures to imitate.

Insert Table 5 about here

Given the difficulties involved in training some individuals to carry out the instructions, as well as the possibility that infants might pay more attention to a novel person in novel surroundings, it was decided that the experimenter herself should perform the situations with the babies.

Experiment 3

Subjects. An advertisement was placed in the local newspaper asking for the participation of three- to six-month-old infants. One three-month-old infant was seen at first, but it became necessary to accept two seven-month-old infants in order to complete the experiment. In all, there were 12 babies, between three and seven months of age. Mothers were paid $6.00 for their

participation and were asked to bring their infants to the laboratory at a time of day when they thought that the baby would be "alert and ready to play". The distribution of age and gender is presented in Table 6.

Insert Table 6 about here

Equipment. Videotaping was done in the same room as before (see Figure 3). The vinyl-covered changing table (85cm X 46cm X 87cm) was placed against the wall opposite the second large table. The counter held two 19" TV monitors, two SONY videocassette recorders (Model VO-2600), a camera adapter (SONY Model CMA-4), and a cassette tape recorder. Brown paper, extending from the ceiling to the edge of the counter, hid this equipment from view.

In order to accommodate individual preferences, and allow for greater freedom of movement, it became necessary to abandon the "split-screen" approach which restricted the space in which both mother and baby could move and still remain within the camera's limits. A second videocassette recorder was used, so that each recorder could be used to record either the mother or the baby.

To the right of the blackboard was the entrance to a

small room, equipped with various baby supplies and several chairs. This room provided mothers with a place to take the baby for soothing, or in which to wait, in case their presence in the experimental room proved to be distracting to the baby.

The two videotapes were temporally co-ordinated for playback by feeding a pre-recorded tape of a metronome ticking, with a count made on every four ticks, directly into the second audio channel of each videocassette recorder. Thus, for playback, either Channel 1 (the audio recording of the play session) or Channel 2 (the counting) could be heard. At any given point in playback, the counting could be accessed in order to temporally match one recording with the other.

A Shibaden FP-100 camera was set on a Samson tripod between the end of the large table and the counter, so that it focused on the center of the room. Another camera (Philips, Type EL 8000/12) was suspended from the ceiling at the same end of the room, at a 75^{o} angle, so that it focused on the floor at the center of the room. Of these two cameras, only one was used for a specific videotaping session, and either one could be connected to the first videocassette recorder. Given the choice of these two cameras, it was possible to achieve a more

direct view of the subject's face, regardless of how the play situation was arranged. On the other side of the room, between the changing table and the counter, was located a SONY Portapak camera (Model AVC-3450) on a tripod, also focused on the centre of the room. Each camera was approximately six feet from its subject's face.

One microphone, connected to one videocassette recorder, was suspended from the ceiling, about 3.5 feet above the centre of the floor. The other microphone, from the other videocassette recorder, was wrapped in foam rubber and placed on the floor, directly behind the baby's head, so that it would be out of his view.

The position in which the baby was placed was determined by the mother, who was asked how she thought the baby would prefer to play at that time. The choices, derived from the pilot studies, were (1) a large blanket on the floor, (2) the infant car safety seat, (3) the changing table, and (4) the experimenter's lap. In fact, two of the alternatives were never chosen. All infants were placed on a large blanket and vinyl pad on the floor in the centre of the room, or in a General Motors Infant Safety Carrier (63.5cm X 38.1cm X 50.8cm).

Throughout the play session, the experimenter was

given tape-recorded instructions at 35-second intervals, through a small earphone. This tape recorder was in a drawer below the counter and therefore out of view.

Procedure. Mothers and their babies were received in the laboratory as in Experiments 1 and 2. The play situation was described to the mother in the following way.

> I would like to videotape your baby and I as we play together for several minutes. While I play with your baby, I would like to try several different things:
> (1) As I play with your baby, I will also be trying to imitate everything he/she does.
> (2) Another thing I will be doing is playing with your baby and trying to make him/her smile once. Then, once your baby has smiled, I will keep playing with him/her, but won't smile unless he/she smiles. This way, I will be imitating his/her smiling.
> (3) The other thing I will do is play with your baby as before, but try not to imitate anything he/she does.
> As I play with the baby, I will change

> back and forth, from one situation to another, repeating each situation. Even though I will be changing what I do, it will seem like one long play session to your baby.

The mother was then asked the position in which she thought her baby would prefer to play. This flexibility was allowed in order to maximize the chances of the baby's being in a playful and receptive mood.

In placing the baby in a comfortable position, the mother remained for a few minutes, talking and playing with him or her. At this time, the experimenter focused the cameras on mother and baby. She then turned on the two videocassette recorders simultaneously, the tape-recorded metronome, and tape recorder with instructions, finally seating herself in the mother's place and beginning play according to instructions.

The three types of situation were arranged in various orders, as in Experiments 1 and 2. When each instruction was given, during videotaping, the experimenter briefly touched her head in order to visually indicate that an instruction had been given. This was not entirely necessary, since the tape-recorded instructions were 35 seconds apart, but served to make the occurrence of an instruction more precisely known during playback.

After taping, the experimenter spent some time with the mother and baby, and usually showed the videotape of the baby to the mother. The mother was then thanked and paid.

Any equipment with which babies came into contact, such as the surface of the changing table, the car seat, table tops, or vinyl mat were wiped with sterile cotton balls and alcohol in order to insure their cleanliness. The large blanket was washed regularly, even though babies did not usually lie directly on the blanket, some having their own blankets and some using the vinyl mat placed over the blanket.

Observational Measures

In Experiment 3, 24 three-minute videotapes were made; one of each baby and the corresponding videotape of the adult experimenter. Two observers (one male and one female) recorded the following infant behaviours: (1) frequency of smiling, (2) facial expression, (3) eye contact, (4) actions, and (5) vocalizations, and the following adult behaviours: (1) facial expression, (2) actions, and (3) vocalizations.

The two observers first watched pilot tapes to determine if these behaviours could be readily identified. The next steps were to establish criteria by which to

judge each behaviour, as well as inter-observer reliability of an acceptable level.

Development of rating scales and criteria. The two observers were initially shown several tapes from the pilot studies and asked to identify various behaviours. For example, they were to indicate when they saw the baby smile. The criteria for judging when a particular behaviour occurred was discussed until it was agreed upon and written as a definition. For behaviours rated on a scale, such as facial behaviour, the observers were asked to identify, describe, and discuss as many different facial expressions as possible. The tape was played again and various expressions were agreed upon as being easily identifiable and displayed by several babies. This procedure was repeated until a scale was established which defined each expression and covered a logical progression of change (e.g. laughter to crying) with as many steps in the progression as could be discriminated.

Definitions of infant behaviours. Smiling was defined as an event in which the infant's eyes were crinkled and cheeks vertically creased, mouth open and elongated, and was observed with an inter-observer reliability coefficient of .98 (calculating the number of agreements divided by the total number of agreements

and disagreements).

Infant facial expression was coded on a seven-point scale:

(1) laughing

(2) smiling - defined as in the frequency of smiling measure above.

(3) playful - mouth open, eyes wide open, cheeks vertically creased, eyebrows raised.

(4) receptive - mouth open, eyebrows slightly curved, and eyes tracking the adult's motions.

(5) serious - eyebrows level, straight mouth, no cheek creases, eyes open but not widely.

(6) fussing - short catches of breath, eyebrows drawn, no smile.

(7) crying - 'knitted' eyebrows, mouth open, actual crying.

Infant facial expression was observed and coded with a reliability of .89 (Kendall Rank Correlation coefficient).

Since the experimenter constantly looked at the infant during taping, eye contact occurred when the infant looked at the experimenter. During the brief period prior to being given the first instruction, the experimenter assumed her position for playing with the infant. At this time, she talked to and smiled at the baby and made certain that eye contact was established. On videotape,

the focus of the infant's eyes during this initial period provided a criterion for judging the occurrence of eye contact throughout the tape. Three types of eye contact were recorded:

(1) full eye contact - defined as the baby keeping his eyes fixed on the adult for the entire duration of the three-second segment being coded.

(2) mixed eye contact - defined as the baby making eye contact with the adult for some portion of the three-second segment, but not all of it.

(3) no eye contact - defined as the baby not looking at the adult at all during the coded segment.

Using the coefficient of agreements formula, inter-observer reliability was .97.

Several specific hand and play actions were rated as well. These behaviours, hereafter called 'actions' included:

(1) smacking the lips to make a popping sound

(2) putting a hand or object in the mouth or touching the lips

(3) making a vibrating sound by loosening the lips and blowing out forcibly.

The coefficient of inter-observer reliability (using the agreements formula) was .97.

The infant's vocalizations were ignored if they were not loud enough to score. The codes used for rating the baby's vocalizations were:

(1) same sound - in which the baby repeated the last sound that he/she had made.

(2) sounds - in which the baby made a different sound from the last sound he/she had made.

Reliability of the coding of this measure was calculated from the ratings of both the infant's and the adult's vocalizations because they were scored together. Using the agreements formula, inter-observer reliability was .89.

Definitions of adult behaviour. Adult facial expressions, due to a less clear videotape image, were less precisely classified than were those of the baby. Thus, the first two categories of infant facial expression (laughing and smiling) were to correspond to the first category of adult facial expression: smiling and/or laughing. The second category of adult facial expression was one of 'playfulness' in which the adult had her mouth open without smiling and was usually engaged in creating various noises for the baby's amusement. This category corresponded to categories 3 and 4 on the infant facial expression scale, since these categories involved

playful expressions and noises on the baby's part. The third category of adult facial expression was one of seriousness, in which the adult's mouth was closed, straight, and unsmiling, corresponding to the fifth infant facial expression ('serious'). The sixth infant facial expression ('fussing') occurred only once at the end of a session and therefore was not imitated by the adult. Reliability of this measure reached .91 (Kendall Rank Correlation Coefficient).

Adult hand and play actions (hereafter called 'actions') were coded as well. These included not only the three actions described under infant behaviour but the following three actions as well:

(1) tickling the baby's stomach

(2) 'exercising' the baby's arms or legs by holding the hands or feet and moving the limbs.

(3) redirecting the baby's attention to the adult by turning the baby's head and/or trunk, or by replacing crawling babies on the blanket.

Inter-observer reliability for these actions was .95, using the agreements formula.

As they were for infants, adult vocalizations were ignored if they were not loud enough to be scored. The codes for rating the adult's vocalizations included

those for the babies (making 'sounds' or 'same sounds') as well as the following:

(1) talking - defined as sounds which the baby could not make, including nonsense words (e.g. 'oops!') and comments made to the baby.

(2) imitation - in which the adult imitated a sound made by the baby.

Inter-observer reliability. To train the observers, a tape from one of the pilot studies was shown with the two observers and the experimenter rating only one of the above behaviours throughout each showing of the tape. Three seconds of the tape were shown at a time. While the recorder was stopped, the observers rated the particular behaviour being measured as it had occurred during the segment. The tape was played as often as necessary to achieve an inter-observer reliability of .95, using the agreements formula. This formula was used, even for behaviour rated on a non-dichotomous scale, because it is a more stringent test of reliability and is easily calculated.

During the rating of experimental tapes (a process which was completed in approximately 150 hours altogether), two observers were always present, but rating independently. The dichotomous rating of whether or not

the infant had smiled in a three-second segment was made by one of the observers and the experimenter, due to demands on the second observer's time. All other measures were rated by the two observers. Ratings were all pre-printed on one sheet of paper and observers simply put a line through one rating of each behaviour per three-second segment. From time to time during actual rating sessions, non-experimental tapes were played and discussed to sharpen inter-rater agreement.

Results

In Experiment 3, the babies were more attentive to the adult and fussed much less. As in Experiments 1 and 2, out of the 14 babies first scheduled for videotaping, two did not complete the session. Both of these babies were just over seven months old and made repeated attempts to crawl off the blanket before they began to cry. Of the 12 babies whose data have been analyzed, none fussed, and only two were distracted to the point that their attention was re-directed more than five times. The remaining ten babies completed the full play period with fewer than five incidents of refocusing attention.

Furthermore, there was a marked increase in the frequency of smiling under both the Non-imitation and

Imitation conditions, although frequency of smiling under the 'imitates smiles' condition remained the same (see Table 7).

Insert Table 7 about here.

The procedure employed in Experiment 3 seemed to facilitate the babies' playful behaviour in the lab situation in that they fussed less, paid more attention to the adult, and smiled more often.

Error Data

Since the split-screen was not used in Experiment 3, errors made by the experimenter during Experiment 3 were counted from the data collected by the videotape observers, rather than viewed directly on the screen. An error was counted if the experimenter either failed to imitate a behaviour which should have been imitated or imitated a behaviour which should not have been imitated.

The observations were made in sequential three-second time periods. This meant that the occurrence of the same time period could not indicate who had first emitted that behaviour or whether it had occurred coincidentally. Thus, an error was counted if the experimenter had emitted or not emitted (in opposition

to the demands of the specific condition) the same behaviour as the infant within the following three-second time period.

The number of errors made in carrying out each condition are listed in Table 8, with corresponding data from Experiments 1 and 2 for comparison.

Insert Table 8 about here

Although there is an overall decrease in the frequency of errors made when the experimenter carried out instructions, the differences reflect only a slight improvement over Experiment 2. That is, once instructions were clearly understood by the adult, as they were in Experiments 2 and 3, the resulting frequencies of error were similar, regardless of who followed the instructions.

Analysis of Frequencies of Observational Measures

The frequency of occurrence of each dependent measure was counted for both males and females under each of the three conditions ('imitate', 'don't imitate', and 'smiles').

The cell means and variances of the 'number of three-second segments in which a smile occurred' were found to be correlated. Thus, the nonparametric rank

sum test (Dixon & Massey, 1969, p. 345) was used. This test indicated that the number of smiles occurring in each condition did not differ significantly (H = 1.497, df = 2). However, the rank sum test revealed that male infants smiled in significantly more time segments than did females ($384.6 > T' > 280.3$, $p < .05$).

One other measure showed significant differences in the investigator's behaviour according to the condition. During the 'imitate' condition, the investigator's facial expression was rated as being 'serious' most often ($F(2,2) = 8.069$, $p < .01$). This difference reflects the demands of the 'imitate' situation, in which the investigator was to only imitate the infant's behaviour, rather than initiate new activity or attempt to amuse the baby.

Sequence Data

More detailed analysis concerning the infants' performances centered on the interaction between the infants and the adult. The distinction of the situation under which a behaviour occurred was eliminated, so that for each baby, there were data for one ongoing play session, with no reference to the instructions given the adult during the session.

The data were then searched for the occurrence of

each of the following sequences of behaviour. (For the purposes of this discussion, 'action' refers to any behaviour other than smiling.)

1) infant smile - adult response - infant smile

2) infant action - adult response - infant smile

3) infant action -adult response - infant action

Sequences in which the adult's response was in imitation of the infants' smiles or actions were counted separately from sequences in which the adult's response was non-imitative.

In Table 9, the frequencies of these three behaviour sequences during which the adult imitated the infant are presented. Similar data from sequences in which the adult did not imitate the infant are presented in Table 10.

Insert Tables 9 and 10 about here

The data from Tables 9 and 10 were used to derive Table 11. Each entry in this table corresponds to a cell in Table 9 or 10. For each corresponding cell in these two tables, the frequencies of occurrence were totalled, as well as the number of opportunities for occurrence of the particular sequence. For example, in Table 9, the adult imitated all infant smiles. The number of times

the infants smiled back were totalled, as well as the number of times the infants did not return the smile. Each entry in Table 11 comprises the total frequency with which infants emitted a behaviour following the adult's imitation or non-imitation of that behaviour divided by the number of times the adult imitated (or did not imitate) the initial infant behaviour. In Table 11, the proportion in each cell is also stated as a percentage.

Insert Table 11 about here

Comparisons of the values in Table 11 were conducted using a proportion test (Walker & Lev, 1953, p. 78). The comparisons made in these seven tests are described below, and results are presented in Table 12.

Insert Table 12 about here

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1) The first test compared the proportional frequency with which the infants smiled following the adult's imitation of their smiles and the proportional frequency with which the infants smiled when the adult did not imitate smiles. The two proportions were not found to be significantly different.

2) The infants more frequently repeated an action when it was imitated by an adult than when it was not imitated ($p < .01$).

3) A third test compared the frequency with which infants smiled when their smiles were imitated and the frequency with which infants smiled when their actions were imitated. Infants smiled more often when their smiles were imitated than when their actions were imitated ($p < .01$).

4) Infants smiled equally often whether the adult imitated or did not imitate their actions.

5) Infants were more likely to repeat actions that were imitated by the adult than they were to smile when actions were imitated ($p < .01$).

6) Infants were more likely to repeat actions that were not imitated by the adult than they were to smile when actions were not imitated ($p < .01$).

7) The frequency with which infants smiled when the adult did not imitate smiles was greater than the frequency with which infants smiled when the adult did not imitate actions ($p < .01$).

8) As shown in Table 13 and listed in Table 12, two proportions were combined and compared to two other proportions, in order to compare the effects of imitation

in general with those of non-imitation. It was found that infants were more likely to repeat smiles or actions when they were imitated, than when they were not imitated ($p < .01$).

Insert Table 13 about here

Discussion

One hypothesis of this study is supported by the finding that, in general, infants did repeat a behaviour more frequently when it was imitated by an adult.

When actions other than smiling are considered alone, it was shown that adult imitation increased their frequency compared to non-imitation. This result supports the findings of Fouts, 1975; Fouts *et. al.*, 1976; Kauffman *et. al.*, 1977; Parton and Preifert, 1975; Thelen *et. al.*, 1975, in which various behaviours of schoolchildren increased in frequency when they were imitated, as well as the Haugan and McIntyre (1972) study, in which 3 - 6 month old infants vocalized more when imitated than when other reinforcers were applied. The present study found not only that 3 - 7 month old infants increased the frequency of their behaviour when imitated, but that this effect applies to behaviours other than vocalizations.

However, there was an unexpected finding. Imitation of infant smiles did not increase their frequency. While it can be said that infants were more likely to repeat their actions and vocalizations when these were imitated, it was also shown that smiling as a behaviour was not subject to this particular effect.

In studies in which social reinforcement (smile, touch, and vocalization) continued throughout the session in response to the infants' smiles, smiling increased (Brackbill, 1958; Brossard & Gouin-Decarie, 1968; Etzel & Gewirtz, 1967; Macdonald & Silverman, 1978; Roedell & Slaby, 1977; Tautermannova, 1973; Wahler, 1967; Zelazo, 1971). An important aspect of the present study is its separation of these components of social reinforcement. The adult's response to infant smiling consisted of smiling alone, unaccompanied by sound or touch, a contingency which had not previously been studied. Imitation of infant actions and vocalizations was done without smiling, so that the effect of simple imitation could be measured. By separating the components of social reinforcement, the effect of each component as a reinforcer could be compared to the effect of the other components, as well as to the documented effects of the combination of these components.

One component of the smile, touch, and sound combination, a smile from the adult, was hypothesized to increase smiling. However, simply smiling at the infant in the present study neither induced nor maintained infant smiling, whereas the combination of touch, smile, and sound in other studies was effective in this way. Future studies should focus on touch and vocalization as separate components of adult response and their respective effects on the infant smiling response.

It was also hypothesized that infants would smile more when their actions were imitated. The results of this study show that the adult's imitation of infant actions such as vocalizations and hand play did not cause the infants to smile more frequently. Regardless of adult imitation, infants were more likely to smile again after having smiled once, than they were to smile after performing an action. Control of the adult's behaviour through imitation did not induce infant smiling. This was unexpected since studies by Gunnar-Vongnechten (1978); Wahler (1967); Watson (1972); and Watson and Ramey (1972) found that infants smiled when they could control mobiles, and Field (1977) and Pawlby (1977) observed infants smiling when their mothers were imitating their actions. In these studies, the duration of the imitation situation

was longer (e.g. 3 minutes) than the 30-second segments of the present study. In Field's study, infants responded to imitation when it occurred for more than 30 seconds, indicating that a longer period of imitation is necessary to produce infant smiling.

Furthermore, Field (1977) noted that the infants smiled and laughed in a "gamelike nature in which the same infant behaviours and the mothers' imitations of them were repeated several times in succession" (p. 769). This observation is compatible with the appearance, in the present study, of 'bursts' of activity between adult and infant, in which the adult and infant alternated in making the imitated response. However, within the 30-second time segment, there was time to merely begin to establish this response pattern (if it was established at all) before a different situation had to be applied (e.g. non-imitation). It appeared that during the beginnings of the response exchange, infants were eventually going to smile, as they did become increasingly excited. When the adult suddenly ceased to return the response (due to situation change), the ongoing game was interrupted and the infants did not smile at this time. Thus, no smiling would have been recorded for the imitation situation, although the frequency of response increased. Future

research in this area might forego established time segments and simply carry out situational instructions until several 'bursts' of gamelike activity have been recorded.

Imitating infant smiles and actions did not cause infants to smile more, but did cause infants to repeat their actions. If infants smiled initially, they were likely to smile again, regardless of the adult's response. They were more likely to repeat an action, however, if it was imitated by the adult. Infant smiling was independent of adult imitation, whereas infant actions were dependent on the adult's response.

It is necessary to consider the extent to which infants were aware of being imitated in their actions. If infants engaged in a behaviour of which they were currently unaware, such as putting a hand in the mouth while looking at the adult, they would have failed to recognize the adult's hand in her mouth as being imitation. Furthermore, they would not have perceived that they had effectively controlled the adult's behaviour in that instance.

Vocalizations were one type of behaviour which infants did seem to be aware of performing. They appeared to be quite excited after producing vocalizations. As the

adult imitated each sound, infants seemed to produce the sound at shorter intervals until both adult and infant made the sound simultaneously. Often, the infant would smile up to this point, then return to a quiet state.

It is possible that vocalizations and their imitation may constitute a type of situation for infants that differs from imitation of hand actions and smiling, in that the infant appears to be well aware of his sound production and that a 30-second interval is adequate time for smiling to occur in response to imitation. Further study of the infant's degree of awareness of his/her own behaviour would be an interesting area of future research.

Imitation itself is a unique form of reinforcement. Infants could control not just the occurrence of an adult's response, but also the nature of that response. Their increased rate of response when imitated may have been related not only to the contingency of adult response, but to a perceived similarity between their behaviour and that of the adult. Further study could compare the infant's behaviour when followed by a non-imitative but contingent adult response to the infant's behaviour in an imitation situation, to determine if the similarity of the adult's response is a factor in increasing the frequency of that behaviour.

The results of this study and subjective observation indicate that infant behaviours are not all subject to similar rules. While other behaviours could be increased through imitation, this was not true of smiling. Infants responded to being imitated in different ways depending on the type of behaviour imitated, indicating that not all infant behaviours are operantly equivalent. Certainly, infant behaviour needs much further study to determine the extent to which infants are aware of it and what functions it may possibly serve.

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Table 1

Order in which Situations Occurred in Experiment 1

A	B	C	D	E	F
1	1	1	1	1	1
2	2	3	3	2	3
1	1	1	1	1	1
3	3	2	2	2	3
1	1	1	1	1	1
2	3	3	2	3	2
1	1	1	1	1	1
3	2	2	3	3	2

Table 2

Errors Made by Adult in Experiment 1

Situation	Error	Frequency
Don't imitate	Mother imitates smile	7.5[a]
	Mother imitates behaviour	3.0[a]
Imitate smiles	Mother fails to imitate smiles	2.0
	Mother imitates behaviour	6.0
Imitate everything	Mother fails to imitate smiles	0.0
	Mother fails to imitate behaviour	5.0
Total number of errors made by adults in Exp.1		24.5

[a]This value is based on four occurrences of this situation for each baby, but the actual number of errors made was divided by two, since there were only two occurrences of each of the other situations for each baby.

Table 3

Infant Fussing in Experiments 1 and 2

Degree of fussing	Number of infants displaying each degree of fussing	
	Experiment 1	Experiment 2
Videotape incomplete, due to onset of crying	2	3
Fussed for 30 consecutive seconds, or cried during latter situations	5	1
Stopped for break because of crying	2	2
Did not fuss extensively, but paid little attention (attention refocused five times or more)	3	5
Did not fuss; attentive	1	3
Total number of infants	13	14

Table 4

Experiments 1 and 2:

Frequency of Infant Smiling in Each Situation.

Situation	Experiment 1	Experiment 2
Don't imitate	20.5[a]	28.0[a]
Imitate smiles	27.0	29.0
Imitate everything	13.0	16.0

[a]This value is based on four occurrences of this situation for each baby, but the actual number of errors made was divided by two, since there were only two occurrences of each of the other situations for each baby.

Table 5

Errors Made by Adult in Experiment 2

Situation	Error	Exp.1	Exp.2
Don't imitate	Imitates smile	7.5[a]	4.5[a]
	Imitates behaviour	3.0[a]	2.0[a]
Imitate smiles	Fails to imitate smile	2.0	0.0
	Imitates behaviour	6.0	0.0
Imitate everything	Fails to imitate smiles	0.0	1.0
	Fails to imitate behaviour	5.0	14.0
Total number of errors made by adult		24.5	21.5

[a]Raw data were divided by two.

Table 6

Experiment 3:

Number of Infants in each Age Group

	Age in months				
Gender	3	4	5	6	7
Male			2	4	
Female	1			3	2

Table 7

Experiments 1, 2, and 3:

Frequency of Infant Smiling in each Situation

	Exp.1	Exp.2	Exp.3
Non-imitation	20.5[a]	28.0[a]	39.0[a]
Imitate smiles	27.0	29.0	28.0
Imitation	13.0	16.0	44.0
Total	60.5	73.0	111.0

[a]This value is based on four occurrences of this situation for each baby, but the actual number of smiles was divided by two, since there were only two occurrences of each of the other situations for each baby.

Table 8

Experiments 1, 2, and 3:

Number of Errors made by Adult

Situation	Error	Exp.1	Exp.2	Exp.3
Non-imitation	Imitates smiles	7.5[a]	4.5[a]	3.6[ab]
	Imitates behaviour	3.0[a]	2.0[a]	0.0[ab]
Imitate smile	Fails to imitate smile	2.0	0.0	0.0[b]
	Imitates behaviour	6.0	0.0	0.9[b]
Imitation	Fails to imitate smile	0.0	1.0	5.5[b]
	Fails to imitate behaviour	5.0	14.0	7.3[b]
Total number of errors made by the adult:		23.5	21.5	17.3

[a]This value is based on four occurrences of this situation for each baby, but the actual number of errors made was divided by two, since there were only two occurrences of each of the other situations for each baby.

[b]There were eleven babies in each of Experiments 1 and 2, but twelve babies in Experiment 3. These values are prorated out of eleven babies so as to be comparable to the raw data in Experiments 1 and 2.

Table 9

Frequencies with which Babies Repeated Smiles and Other Behaviours when these were Imitated

	Infant's behaviour			
Adult's behaviour	Baby smiles	Baby does not smile	Baby repeats behaviour	Baby does not repeat behaviour
Imitation of smile				
Males	42	20		
Females	10	7		
Imitation of non-smiles				
Males	14	24	26	12
Females	11	62	54	19

Table 10

Frequencies with which Babies Repeated Smiles and Other Behaviours when these were not Imitated

Adult's behaviour	Infant's behaviour: Baby smiles	Baby does not smile	Baby repeats behaviour	Baby does not repeat behaviour
Non-imitation of smile				
Males	24	12		
Females	5	6		
Non-imitation of non-smiles				
Males	57	124	104	77
Females	8	151	81	78

Table 11

Proportions of Infant Smiles and Actions Following Adult's Imitation of Non-Imitation of Infant's Initial Behaviour

Adult behaviour	Infant response to adult behaviour: Infant smiles		Infant repeats behaviour	
Imitation of smiles	52/79	(65.5%)		
Imitation of actions	25/111	(22.5%)	80/111	(72.1%)
Non-imitation of smiles	29/47	(61.7%)		
Non-imitation of actions	65/340	(19.1%)	185/340	(54.4%)

Table 12

Comparison Test Results

Proportions Compared			z-value	Probability
(1)	$\frac{52}{79}$	$\frac{29}{47}$	0.4668	p=.33
(2)	$\frac{185}{340}$	$\frac{80}{111}$	-3.2817	p < .01 *
(3)	$\frac{52}{79}$	$\frac{25}{111}$	5.9918	p < .01 *
(4)	$\frac{25}{111}$	$\frac{65}{340}$	0.7793	p=.23
(5)	$\frac{25}{111}$	$\frac{80}{111}$	-7.3935	p < .01 *
(6)	$\frac{65}{340}$	$\frac{185}{340}$	-9.5440	p < .01 *
(7)	$\frac{29}{47}$	$\frac{65}{340}$	6.3811	p < .01 *
(8)	$\frac{132}{190}$	$\frac{214}{387}$	3.2700	p < .01 *

Table 13

Combined Proportions

Adult behaviour	Infant repeats smile or action	
Imitation of smile or action	$\frac{132}{190}$	(69.5%)
Non-imitation of smile or action	$\frac{214}{387}$	(55.3%)

Figure 1

Equipment in Experiment 1

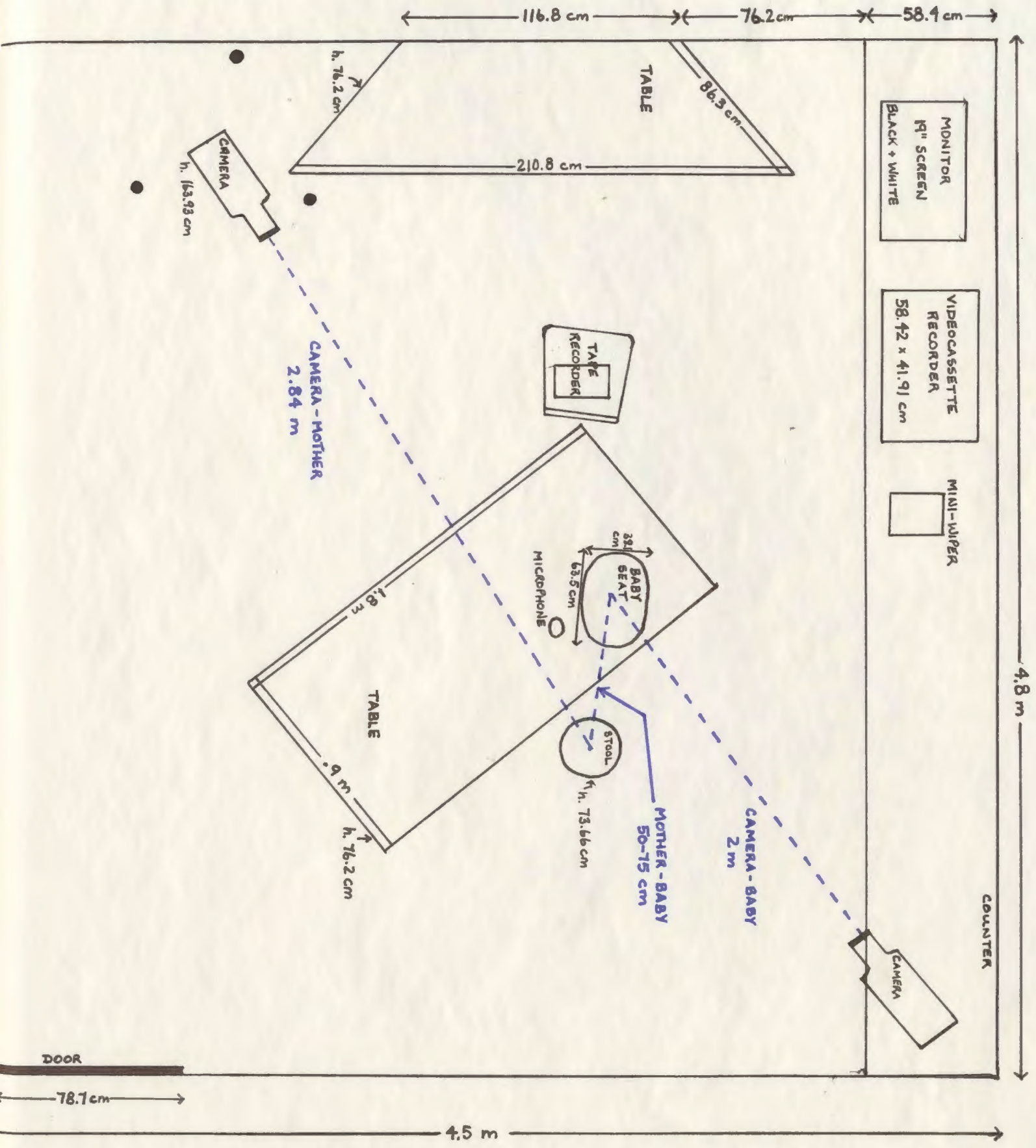
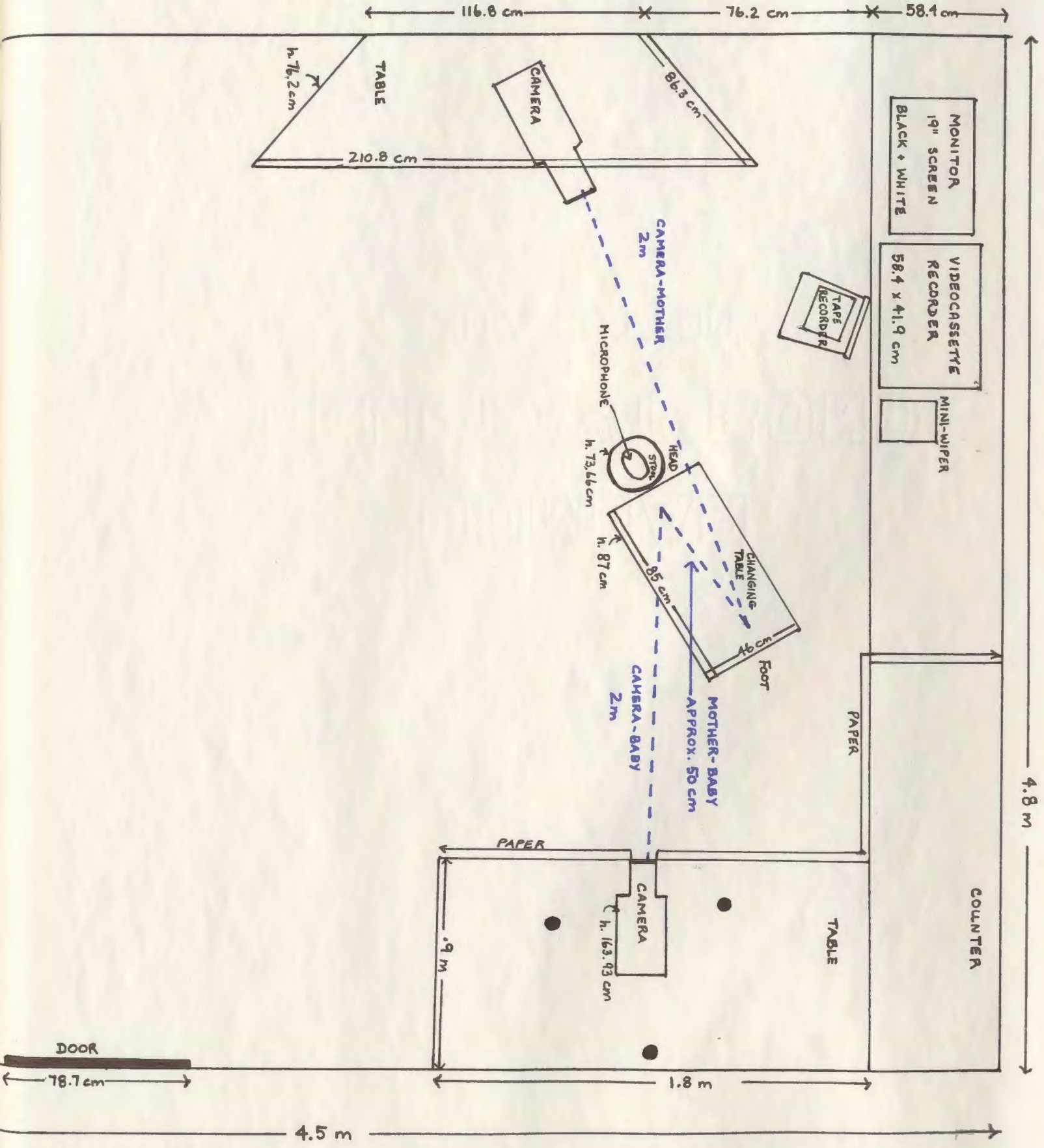


Figure 2

Equipment in Experiment 2



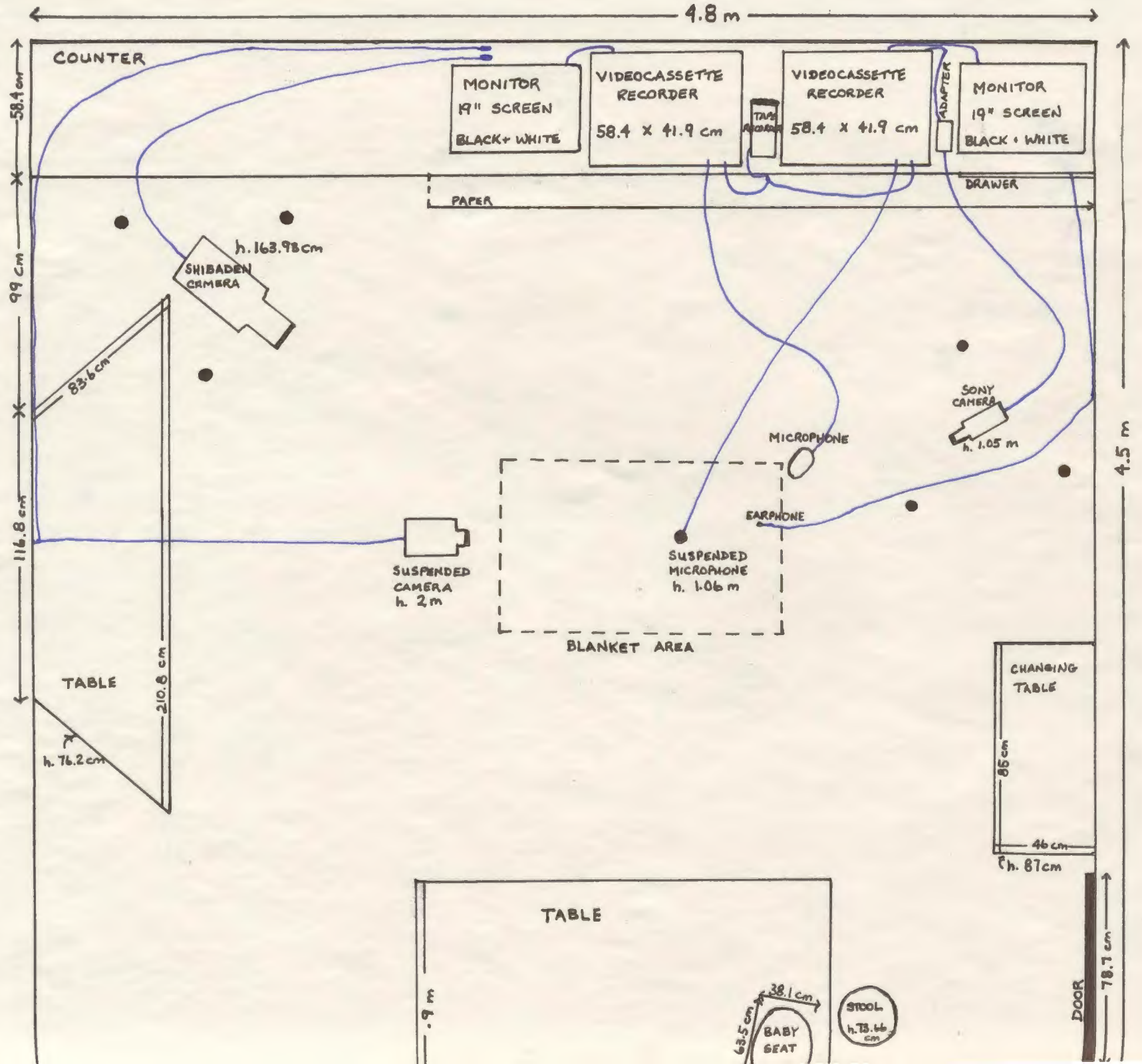


Figure 3

Equipment in Experiment 3