

# EMORY COGNITION PROJECT

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## Can 2-Month-Old Infants Distinguish Live from Videotaped Interactions with their Mother

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## Abstract

Murray and Trevarthen (1985) reported that 2-month old infants could discriminate live video interaction with their mother (Live) from viewing a videotape of her (Tape). This finding has important implications for early social development and the development of the self, and has been widely cited. However, the four subjects of their study were always tested first in the Live, then in the Tape condition. No successful replications of Murray and Trevarthen experiment have been published. We attempted a controlled replication of their study, using a double television system similar to that of Murray and Trevarthen. Ten infants with the mean age of 2 months 21 days were randomly assigned to two groups. One group received the conditions in the Live-Tape-Live order, another group in the Live-Live-Tape order. The first two intervals of the Live-Tape-Live order permitted a precise replication of Murray & Trevarthen's study. ANOVAs showed no significant effect of condition for any of the coded behaviors in the direction reported by Murray and Trevarthen. The second and third intervals of our design permitted a comparison of the infants' behavior in Live and Tape conditions, balanced for order. No effect of condition (Live vs. Tape) was found. We conclude that while two-month-olds may indeed be sensitive to interpersonal contingency, they do not readily demonstrate this ability in the Murray-Trevarthen paradigm.

## Can two-month-old infants distinguish live from videotaped interactions with their mothers?

Murray and Trevarthen (1985) reported evidence that social competencies as sophisticated as sensitivity to interpersonal contingency are present in 2-month old infants. In their experiment, four infants between 6 and 12 weeks of age interacted with their mothers through a TV set-up, either on-line (Live condition) or were presented with a videotape of the mother (Tape condition). Murray and Trevarthen found that the infants were very interactive and content during the Live condition, and showed distress and discomfort during the Tape condition (see Table 1). These findings have important implications for social development and the development of the self, suggesting that young infants are interactive agents, they show turn-taking, differentiate their own self from other selves, and may have formed a concept of interpersonal self (Neisser, 1988, 1993). Unfortunately, their experiment was not conclusive: few subjects were tested and the order of conditions was not counterbalanced. The study has been widely cited, but, in spite of its popularity, no successful replications of the experiment have been published. Few researchers have undertaken investigation of infants' sensitivity to contingency using Murray and Trevarthen's Live and Tape paradigm. Muir (1993) did not find the phenomenon in infants' interactions with mothers at 2 months, or 5 months, but found a decrease in smiling in interactions with a stranger at 5 months. Bigelow (1995) found a linear decrease in attention over time, and a change in facial affect (happy, neutral, sad) across conditions in 4-, 6-, and 8-month-olds. These experiments, however, used a set-up that differed from Murray and Trevarthen's and may have not permitted eye-contact. Another study is currently in progress in France, data are not yet available (Nadel, 1996). Thus our experiment is the first one completed to date that employed a set-up similar to

that of Murray and Trevarthen, allowing for the mother and infant to maintain direct eye-contact. We attempted a controlled replication study, in which we increased the number of infants tested and controlled for the order effect.

## Method

### Apparatus

A double closed-circuit television system was built similar to the one employed by Murray and Trevarthen (1985). The apparatus was set up in two adjacent rooms (see Figure 1). In both rooms, a metal frame structure supported a TV monitor facing down. The image from the TV was reflected in a one-way mirror, placed diagonally in the metal frame structure, facing the participant's seat. A video recorder was placed behind the one-way mirror. The video camera from the infant's room transmitted the image of the baby to the mother's TV monitor. Similarly, the camera in the mother's room transmitted her image to the baby's monitor. This latter transmission went via a videocassette recorder, which allowed for a tape of the mother to be presented in the Tape condition. Sound from the infant's room was picked up by a microphone and transmitted to the mother's earphones. Sound from the mother's room was picked up by a tie microphone, run through the VCR, and transmitted through the TV speaker in the infant's room.

In the infant's room an infant seat was placed facing the one-way mirror. A rectangular mirror was placed on one side behind the infant seat and reflected the image of the mother from the one-way mirror. A camcorder behind the one-way mirror videotaped the baby and the image of the mother reflected in the mirror behind the baby. The camcorder transmitted the split-screen image to an auxiliary TV monitor in the infant's room, allowing the experimenter to monitor the infant's responses. The camcorder tape was later used for coding and analysis.

In order to obtain optimal image and acoustics, the mirror, lighting, focus, image size, and sound were adjusted during piloting. Black cardboard was fixed to the frame structure and around the apparatus, and white cardboard and cloth were placed around the infant to prevent possible distractions.

### Design

All participants were presented with three consecutive 60 s test intervals. In the Live condition the interaction between mother and infant was simultaneous, with concomitant video and audio transmissions between the two rooms. In the Tape condition the infant was shown a videotape of his/her mother, which had been made during the first experimental interval. The first interval was always a Live interaction between mother and infant. The second and third intervals were counterbalanced to be either in the Tape-Live order or in the Live-Tape order. Thus, one group received the conditions in the Live-Tape-Live order, and the other group received the conditions in the Live-Live-Tape order. The first two conditions of the Live-Tape-Live order were an exact replication of Murray and Trevarthen, with N=5. The second and third conditions in both groups (Tape-Live and Live-Tape) allowed for a separate analysis that controlled for order, with N=10.

### Participants

The participants were recruited from a subject pool consisted of infants born in the Atlanta area. Parents were contacted by phone and were invited to participate with their infant. Twelve infants were piloted in the earlier stages of the study in order to adjust optical distance, lighting, sound, and image. Fourteen mother-infant dyads were recruited for the main study. The data from 4 of them could not be used because of excessive fussiness. The mean age of the

remaining 10 infants (3 girls, 7 boys) was 2 months 21 days, ranging from 2 months 12 days to 3 months 00 days. Infants were randomly assigned to the two groups.

### Procedure

All mothers were given a detailed description of the procedure of the experiment and signed an informed consent form. Mothers were asked to engage their child in an active interaction during the Live intervals.

The infant was placed in an infant seat facing the one-way mirror. One experimenter remained in the same room with the infant, the other experimenter accompanied the mother to an adjacent room. A calibration procedure was used to map the infant's visual response to the screen. During calibration, a toy suspended on a cardboard arm was moved around the screen and the infant's visual tracking of the toy was videotaped. To keep the infant engaged, a blackboard with a colorful toy (puppet face) was placed between the baby and the video apparatus before and after calibration and between conditions. After calibration was completed, the mother was seated facing the one-way mirror, and the head phones and microphone were adjusted. The live interaction during the first minute was recorded and was used for the tape condition.

### Coding

The behaviors chosen for coding were the same as those coded by Murray and Trevarthen, and included gaze to mother, tonguing, mouth wide open, mouth closed, eyebrows raised, smiling, frowning, raised frown, left hand fingers clothes, right hand fingers clothes, left hand touches face, right hand touches face, yawning, grimacing/sneering, and biting/chewing lower lip. Three behaviors (gaze away from mother, mouth relaxed, and eyebrows relaxed) were not coded, due to

their reciprocal relation to other behavior(s) (e. g., gaze away from mother is inversely related to gaze to mother). Criteria for each behavior were established.

A computer event recorder was used to code the camcorder tape. Coding was done with the sound off. A key was pressed every time the particular behavior occurred. If it was impossible to track the behavior (e.g., could not tell if mouth was open or closed when infant covered the mouth with his/her hand), a "can not tell" key was pressed. Percent of total time the behavior took place was computed (in those instances when the "can not tell" key was pressed, the "can not tell" time was subtracted from the total time, and the remaining time was used for computing the percentage of time the behavior took place). A main coder coded the infants' behaviors across all three conditions. A secondary coder coded all behaviors for four babies. Both coders were blind to the conditions they were coding. The mean percent agreement between coders was above 90% for all measures. In other words, in the 12 comparisons (4 babies X 3 intervals) available for each of the 15 behaviors, the on-time recorded by one coder was divided by that of the other coder (using the higher value as the denominator). For each behavior, the mean of these ratios was above 0.9.

## Results

### Exact Replication

The first two trial presentations of the Live-Tape-Live order were analyzed as an exact replication of Murray and Trevarthen's experiment. ANOVAs were performed on all coded behaviors. No significant differences between conditions were found (see Table 1). The means for Gaze to Mother, Frowning, and Smiling are shown in Figure 2. Our results did not replicate any of Murray and Trevarthen's findings.



### Order-Controlled Replication

The second and third trial presentations for all infants (Live-Tape-Live and Live-Live-Tape) allowed us to counterbalance the order of the live and tape conditions. ANOVAs were performed on all coded behaviors. The only significant difference between conditions was in smiling (see Figure 4C), but the direction of the effect was opposite to the one expected based on Murray and Trevarthen's findings. Overall, there were no noticeable differences in behavior between the Live and Tape conditions (see Table 1).

### Behaviors by Age

It was suggested by Lynne Murray (personal communication) that this form of interaction may be extremely sensitive to age, occurring only at about ten weeks. Data bearing on this hypothesis are shown in Table 2, in which the subjects are ordered by age. No consistent pattern of change emerges.

### Discussion

The infants in our study did not react differently when watching the mother on-line than when viewing a videotape of the mother. We believe that the difference between our findings and those of Murray and Trevarthen results mainly from procedural differences. Murray and Trevarthen typically allowed their babies to remain in the live condition until an active interchange was reached. The Tape condition followed. A probable consequence of this procedure is that the subjects were at their peak performance in the Live condition, a natural decline from that peak would have produced lower performance in the Tape condition. This decline may have been mistakenly attributed to the change of the experimental conditions. In our experiment, the duration of infants' exposure to each condition was fixed.

It is possible that the double video set-up is not an optimal environment for interpersonal communication in early infancy. It lacks ecological validity in several ways: mothers can not touch or hug their infants, nor can they approach very close. For this reason, our failure to replicate Murray and Trevarthen's findings does not necessarily mean that infants of two months are not sensitive to interpersonal contingency; the double-TV method may just not be an effective way to demonstrate this sensitivity.

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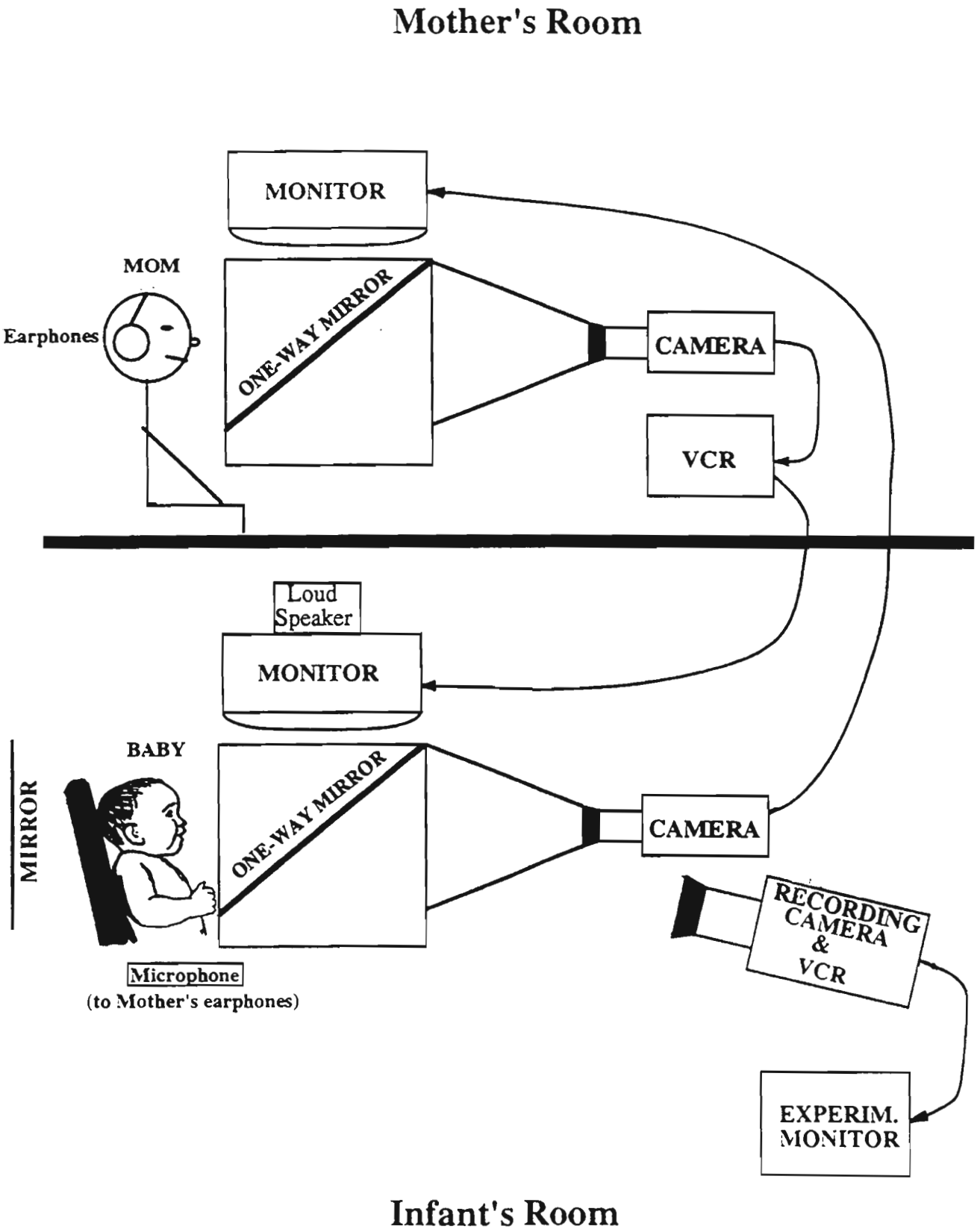
**Table 1.** Infants' Behaviors in the Live and Tape Conditions, Expressed as Percent of Total Time.

Infant Behavior	Murray & Trevarthen (N=4)			Exact Replication (N=5)			Counterbalanced Order (N=10)		
	Live	Tape	p	Live	Tape	p	Live	Tape	p
<b>1. Attention</b>									
Gaze to mother	89.3	63.4	0.001	73.3	79.8	0.28	75.84	75.25	0.94
<b>2. Communicative Effort</b>									
Tonguing	29.2	19.5	0.05	9.8	9.4	0.88	14.12	8.96	0.08
Mouth Wide Open	20.4	5	0.001	2.2	2.5	0.77	5.23	4.13	0.44
Mouth Closed	31.3	36.3	0.001	37.1	35.8	0.81	26.09	29.43	0.51
<b>3. Affect</b>									
<i>Positive</i>									
Smiling	4.9	1	0.1	5.6	5.4	0.9	0.59	3.33	0.03
Eyebrows Raised	38.3	15.6	0.001	5.5	6.9	0.32	5.77	4.37	0.26
<i>Negative</i>									
<i>distress</i>									
Frowning	0.5	25.4	0.0005	0.9	1.8	0.28	5.63	5.87	0.86
Raised Frown	14.5	20.9	0.02	0.9	1.1	0.26	1.85	1.01	0.4
<i>displacement activity</i>									
Left Hand Finger Clothes	15.9	24.6	0.1	1.4	0.8	0.52	6.72	5.47	0.6
Right Hand Finger Clothes	14.9	34.4	0.001	4	0.2	0.06	4.53	6.08	0.61
Left Hand Touch Face	0	1.5		0.6	2.8	0.42	6.52	6.76	0.95
Right Hand Touch Face	0.3	1.8	0.1	7.2	8.4	0.37	5.32	11.22	0.07
Yawn	0	0.8		0	0		1.32	1.61	0.45
Grimace/Sneer	0.4	7.7	0.001	1.6	1.8	0.86	5.83	3.31	0.51
Bite/Chew lower lip	0.1	1.5	0.1	0.6	0.2		1.01	0.09	0.24

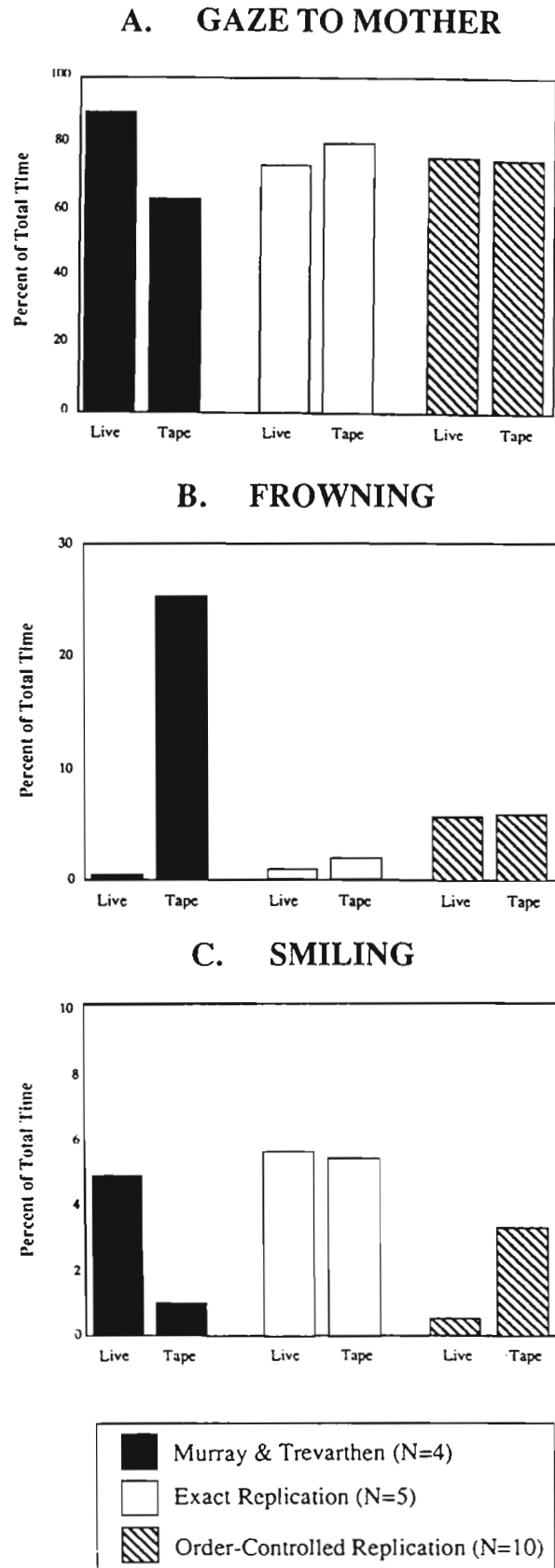
**Table 2.** Behaviors of Individual Infants in the First Live Interval (expressed as percent of total time) as a Function of Infants' Age.

Infants' Age	10w2d	10w3d	10w4d	11w1d	11w3d	11w5d	12w3d	12w4d	12w5d	12w6d
<b>1. Attention</b>										
Gaze to mother	96.46	46.71	47.85	89.77	71.37	74.61	76.23	91.78	87.44	91.23
<b>2. Communicative Effort</b>										
Tonguing	11.24	20.5	1.61	7.19	6.96	1.87	27.25	14.76	7.17	12.14
Mouth Wide Open	1.68	40.49	2.38	7	3.81	0	3.09	11.86	0.95	2.08
Mouth Closed	43.21	26.6	58.8	2.96	17.3	58.61	7.58	0	44	0
<b>3. Affect</b>										
<i>Positive</i>										
Smiling	7.1	0	0	0	13.8	6.98	0	0	3.36	0
Eyebrows Raised	0.63	1.27	21.28	2.81	2.31	1.66	1.6	1.49	0	1.43
<i>Negative</i>										
<i>distress</i>										
Frowning	0	11.04	0.66	1.66	0	0	4.06	3.6	0	34.29
Raised Frown	0	0.88	2.3	1.91	0	0	2.07	1.38	0	0
<i>displacement activity</i>										
Left Hand Finger Clothes	0	30.03	4.15	0	0	0	3.01	10.67	0	0
Right Hand Finger Clothes	0	0	2.68	0	9.02	4.07	4.17	0	61.34	0
Left Hand Touch Face	0	0	1.88	5.96	0	0	0.96	9.52	15.36	0
Right Hand Touch Face	0	20.11	0	0	0	0	35.79	77.22	0	0
Yawn	0	0	0	0	0	0	0	0	0	0
Grimace/Sneer	0	7.91	0	0	0	0.75	7.13	0	1.15	0
Bite/Chew lower lip	0	1.01	0.63	1.3	0	0	2.54	0	0	0

Figure 1. Apparatus.



**Figure 2.** Frequency of infants' gazing, frowning and smiling in the present study and in Murray and Trevarthen's 1985 research.



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