Analysis and Replication of Mother-Child Relations at Two Years of Age

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CLARKE-STEWART, K. ALISON; VANDERSTOEP, LAIMA P.; and KILLIAN, GRANT A. *Analysis and Replication of Mother-Child Relations at Two Years of Age.* CHILD DEVELOPMENT, 1979, 50, 777–793. This study adopted the same cross-dimensional approach to the study of mother-child interaction that was used by Clarke-Stewart in 19... Its major purpose was replication: replication of the 1973 study with different children at a different age (2–2½ years) and replication in a series of four different samples (*N*'s = 14, 30, 31, and 35). Variables included measures of children's cognitive, language, and social development and mothers' attitudes, ability, and behavior, assessed in standardized tests, semistructured situations, and natural observations. Like the 1973 study, this study revealed a general competence cluster for children comprising IQ, language level, and interaction with mother. It was most closely correlated with the mother's positive and responsive interaction and language to the child. The child's sociability to adult strangers was related to mother-child interaction and the mother's attitude and activities, but sociability to another child was not correlated with maternal variables. Replicability in the four samples was examined in terms of methodological independence of variables, comparability of measures, *p* levels for correlation coefficients, differences in sample sizes and means, and predictability of relations from prior research and theory.

Interest in mother-infant interaction has increased dramatically in recent years, absorbing both psychologists concerned with conceptual issues of development and those interested in their practical applications. This interest has led researchers in two directions: to the microanalysis of brief sequences of interaction (Schaefer 1977) on the one hand, and to the study of life beyond the mother-child dyad in the ecological context of the family (Bronfenbrenner 1977) on the other. While both of these research approaches are undeniably important, they do not exhaust the potentially informative methods of investigating mother-child relations. A research strategy between these two approaches (Clarke-Stewart 1973) probes a variety of more molar maternal and child variables with the goal of looking for broad patterns as well as specific relations among variables; it preserves the real-life complexity of mother-child interaction and promises to extend understanding of developmental processes.

Unfortunately, most investigations of mother-child interaction at this level have been limited in scope to single developmental areas: cognitive development, language development, or personality development. Few investigators have simultaneously assessed variables crosscutting different developmental domains, and even when they have included diverse variables they have often reported results from different areas in separate articles (e.g., Beckwith 1971a, 1971b, and 1972; Bayley & Schaefer 1964 and Schaefer & Bayley 1963; Cohen & Beckwith 1976 and Beckwith, Cohen, Kopp, Parmelee, & Marcy 1976; Bradley & Caldwell 1976 and Elardo, Bradley, & Caldwell 1977; Wenar 1976, Note 1). Exceptions to this approach appear in the work of Clarke-Stewart (1973), White & Watts (1973), and Yarrow, Rubinstein, and Pedersen (1975). In the Clarke-Stewart (1973) investigation, infants' intellectual functioning, social interactions, and language behavior, and maternal attitudes, ability, and behavior were assessed with standardized tests, semistructured probes, and natural observations. Multivariate analyses of these variables revealed a cluster of child variables reflecting competence across developmental areas and, related to that child cluster, a comprehensive cluster of maternal variables reflecting "optimal" maternal care. Significant and predictable associations between specific child and mater-

nal variables within these comprehensive patterns were also found.

The purpose of the present study was twofold. The first objective was to extend the Clarke-Stewart method and findings to a different sample, at a different age, using different, but similarly comprehensive, assessment procedures. The second objective was to investigate the replicability of the obtained correlations among mother-infant variables in separate samples of mothers and children. Replicability of mother-child relations is an issue which to date has received little systematic study, and consequently no rules have been established for determining what constitutes replicability in this area. Masters and Wellman (1974) were so discouraged by the apparent lack of replication of correlations among attachment behaviors they suggested using alternative statistical procedures rather than correlations. An opportunity to explore correlational replicability of mother-child relations was offered to the present investigators by the availability of data from two studies which, although conducted for different purposes, had overlapping assessment measures collected on comparable groups of mothers and children.

Method

The two studies were conducted in New Haven from 1972 to 1974. One was an intensive longitudinal study focusing on the social relations of a small number of children (the "panel"); the second was a larger longitudinal study (the "replication") in which children were assessed at 6-month intervals using tests and procedures identical with some of those in the small study. Children for both studies were selected from hospital birth records, and their parents were invited by letter to participate in a study of youngsters' activities and development from 1 to 2½ years of age. This report is restricted to analysis of data gathered in the period from 2 to 2½ years.[1]

SUBJECTS

The panel consisted of 14 children selected at random from the hospital records, with the requirement that they come from two-parent families where the mother was not working and was the child's primary caregiver. Six of the 14 families recruited could be classified as working class (skilled or unskilled blue-collar occupations), the others were middle class (white-collar occupations, college educated). There were equal numbers of boys and girls. In the panel sample, all children were either firstborn (two) or second born (12); all families were white. The replication sample consisted of 96 children who entered the study in three cohorts lagged 6 months apart (N's = 30, 35, and 31). Each cohort also contained an equal number of boys and girls, and children were either firstborn (70% in cohorts 1 and 2, 65% in cohort 3) or secondborn. These families were classifiable as either working class (69% in cohort 1, 66% in cohort 2, 60% in cohort 3) or middle class; families of poverty or professional class status were deliberately excluded. All but 10% of the families were white; all but three had both parents living at home; and, as in the panel sample, the mother was the child's primary caregiver.

ASSESSMENT PROCEDURES

Four kinds of procedures were used for data collection: unstructured "natural" home observations, standardized test, semistructured situations, and an interview. Unless otherwise specified, the same procedures were used with both panel and replication samples.

Natural Observations

One-hour observations were made of children as they behaved "naturally" and spontaneously at home. The observations were scheduled at times during the day convenient for mother and child with no restriction placed on who would be present. Before the observation began the mother was instructed to ignore the observer and, as far as possible, to go about her normal activities while the observer followed the child and recorded his or her activities. Observation recording was done by a system of continuous recording in two-columned notebooks described by Clarke-Stewart (1973). Abbreviations for children's behavior

selected from a preestablished behavior repertoire (e.g., clings, plays, vocalizes) were written in the right column, behaviors of mother in the left column; simultaneous behaviors were recorded on the same line, sequential behaviors on alternate lines. Behaviors that the observer judged to have occurred in direct response to the other's behavior (e.g., child calls and mother comes, mother directs and child complies) were designated R (responsive). Meanwhile, the observational record was marked in 10-sec intervals at the sound of a beeper. At the end of the observation, five-point rating scales (for maternal affect, stimulation, acceptance, and effectiveness) and a checklist for mothers' activities during the observation were filled out. Six such observations were made during the 6-month period from 24 to 30 months for the panel children; two were made in the same age period for the replication sample. For the panel subjects, one observation, at 26 months, was tape recorded.

Standardized Tests

Intelligence tests were administered to both mothers and children. Children were given the Bayley Mental Development Scale at 18 and 24 months and, at 30 months, either the Minnesota Child Development Inventory (panel) or the Stanford Binet Test (replication). Panel mothers were given the vocabulary and picture completion subtests of the Wechsler Adult Intelligence Scale (WAIS); replication mothers were given the Peabody Picture Vocabulary Test (PPVT) and the complete performance subscale of the WAIS.

Semistructured Situations

Mother and child strangers probe.—At 24 months, each mother-child pair was visited at home by an unfamiliar mother and her 3-year-old son. There, directed and prompted by the observer, the unfamiliar mother enacted the following sequence: she sat quietly at some distance from the study child for a minute, she looked, smiled, and talked to him in a friendly way, she invited him to play with her with a toy, approached him if he had not already gone to her, and tried to engage him in cooperative play with the toy and in a social-physical game of "horsie" or "piggy," and then, finally, she disengaged herself from the child, ultimately leaving the house. An identical sequence was followed by the child's own mother, and interspersed between these episodes were free-play periods for the two children with toys provided by the observer. The observer meanwhile recorded the child's reaction to the strangers on a behavior checklist containing the categories looks, smiles, frowns, vocalizes, gestures, frets, cries, touches, touches affectionately, clings, approaches, avoids, stays close, aggresses, gives, and takes.

Peer stranger probe.—At 25 months, randomly assigned, mixed-sex pairs of panel children came to the laboratory playroom at the university. Two kinds of episodes ensued: mothers interacted with their own child and the unfamiliar child in identical situations (teaching a puzzle and a game), and children played together with sets of toys provided by the experimenter while mothers interacted with each other or the children as they chose. Interactions were tape recorded and simultaneously coded by an observer behind a one-way window on a behavior checklist like that used in the mother-and-child-strangers probe.

Stranger probe.—The unfamiliar mother's "approach-and-play" sequence was repeated with a female research assistant stranger, at home, at 30 months. In addition, for panel children only, the child's regular and familiar observer went through the approach-and-play sequence after the stranger. This probe, too, was recorded on tape and the behavior checklist.

Play sessions.—At 24 and 30 months, mother and child were asked to participate in a series of specific play activities: playing with two toy telephones, blowing soap bubbles, making designs with straws, reading a story together, drawing a picture, and playing with a ball. For each play activity the observer rated on five-point scales the mother's positive affect, social stimulation, responsiveness, and acceptance of the child's behavior, and the child's positive affect and cooperation in the activity.

Interview

At 24 months, the mother was interviewed, on tape, about her attitude toward discipline. She was asked a series of questions about hypothetical situations involving her child and a babysitter: for example, "Suppose you left your child with a sitter and he refused to eat, what would you want the sitter to do?" Mothers' responses were later coded into categories of "authoritarian attitude" (mother suggested a direct intervention to change the child's behavior) or "accommodating attitude" (mother suggested changing the environment, including her own or the babysitter's behavior). If a mother gave more than one answer to a question, her first two responses were coded.

RELIABILITY

Seven young women served as observers for the observation and semistructured situations described. Interobserver agreement on rating scales was within one scale point and on checklists was over 90%. When calculated at the beginning and middle of the panel study and at the beginning of the replication study, interobserver agreement for interval-by-interval recording of behavior units in the natural observations averaged 79% (ranging from 75% to 85% for different observer pairs). The intercoder reliability for coding notebook records into measures of behavioral frequencies, durations, and contingencies was approximately 100%. Reliability of observational measures was further examined by correlating data from pairs of panel observations for the same child over this 6-month period. The correlation coefficients obtained ranged from .00 to .81. Unstable behavior units, with coefficients less than .42, were dropped from further analysis.

DATA REDUCTION

Correlational and principal-components analyses were performed on the entire set of observation, probe, and test measures for panel and replication samples in order to derive variables that were relatively complex, robust, reliable, and methodologically independent. When measures that were conceptually and/or methodologically related were correlated significantly ($p \leq .05$) and consistently (across samples), and when they appeared in the same component in a principal-components analysis done for the total replication sample, they were combined. The 22 variables thus obtained, the means of selected measures, and the average of the correlation coefficients (r_{av}) between pairs of measures comprising each variable are as follows:[2]

Child variables:

1. *Intelligence.* Bayley Mental Development score at 24 months ($M = 100$, $SD = 21$) + change in Bayley score from 18 to 24 months + Minnesota Child Development Inventory (MCDI) score (panel) or Stanford Binet score (replication) ($r_{av} = .62$).

2. *Language level.* Proportion of utterances that were intelligible words + MLU (mean length of utterance, in words, of those utterances that used words; $M = 2.3$, $SD = 0.6$) + MLU of child's lon-

gest 10% of utterances (panel only; $M = 5.8$, $SD = 1.6$), calculated from tape transcript of interaction with stranger at 30 months ($r_{av} = .93$).

3. *Descriptive speech.* Percentage of child's utterances with a person or physical object as real or implied subject, calculated from tape transcript of child's interaction with stranger at 30 months.

4. *Physical attachment to mother.* Number of 10-sec periods in which child approached + touched mother in natural observations + amount of physical contact with mother in stranger probe at 30 months ($r_{av} = .60$).

5. *Plays with mother.* Frequency with which child looked at + smiled at + vocalized to + initiated play with mother, during stranger probe at 30 months + mean rating of child's cooperation + positive affect in semistructured play sessions with mother at 24 and 30 months ($r_{av} = .71$).

6. *Interacts with mother.* Number of 10-sec periods in which child looked at mother ($M = 0.31$, $SD = 0.18$) + smiled at mother ($M = 0.03$, $SD = 0.03$) + vocalized or talked to mother ($M = 0.18$, $SD = 0.13$) + played with mother or gave or showed her an object (panel only; $M = 0.03$, $SD = 0.03$) + average duration of an "episode" of looking at mother + proportion of maternal social behaviors (smile, talk, give, show, offer, play) to which child responded appropriately (look, smile, play, imitate, talk) within the same or next 10-sec period ($M = 0.41$, $SD = 0.25$)—all in natural observations ($r_{av} = .73$).

7. *Stranger anxiety.* Amount of negative behavior (cry, fret, avoid, hit) directed at unfamiliar mother in mother-and-child-strangers probe at 24 months.

8. *Interacts with stranger.* Amount child approached, stayed near, or touched + vocalized to unfamiliar mother in mother-and-child-strangers probe at 24 months + amount of physical proximity and contact + vocalization to stranger in stranger probe at 30 months ($r_{av} = .57$).

9. *Interacts with peer.* Amount child looked + vocalized = smiled or played with + offered or gave object + touched, went to, or stayed near unfamiliar child in mother-and-child-strangers probe + same behaviors directed to the unfamiliar child in the peer-stranger probe (panel only) ($r_{av} = .51$).

10. *Plays with observer.* Amount child played with observer in observer part of stranger probe (panel only).

Maternal variables:

11. *SES.* Mother's education (number of years) + father's education (number of years) + father's occupation (number from 1 = unskilled labor to 7 = professional occupation) ($r_{av} = .70$).

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[2] The measures that were correlated and combined to form these variables are separated in the descriptions of the variables by + (plus) or − (minus) signs, indicating that they were added or substracted to create the variable.

12. *Intelligence.* Mother's WAIS score (+ PPVT score for replication sample).

13. *Accommodating attitude.* Number of solutions to hypothetical problems in attitude interview that proposed changing the environment not the child's behavior—those favoring an authoritarian strategy of direct disciplinary intervention ($r = -.89$).

14. *Descriptive speech.* Percentage of mother's utterances to the child in which the subject was a physical object or a person (including mother but not child) — percentage of utterances that were directive and suggested that the child do something, calculated from tape transcripts of natural observation and episodes when mother showed child toys (in peer-stranger probe for panel and semistructured home visit for replication) ($r = -.70$).

15. *Language level to child.* Percentage of mother's utterances to child that were questions + mother's MLU to child + difference between mother's MLU to child and child's MLU to mother, all calculated from tape transcripts of natural observation and peer-stranger probe (panel only) ($r_{av} = .80$).

16. *Language II to child.* Difference between mother's MLU to interviewer and her MLU to child + proportion of child's vocalizations to which mother responded verbally in natural observations (panel only) ($r_{av} = .59$).

17. *Plays with child.* Mean rating of mother's positive affect + social stimulation + responsiveness + acceptance, in semistructured play sessions.

18. *Interacts with child.* Number of 10-sec periods in which mother praised or played with child ($M = 0.09$, $SD = 0.08$) + talked to child ($M = 0.24$, $SD = 0.14$) + looked at child ($M = 0.50$, $SD = 0.22$) + mean rating of mother's play stimulation + verbal stimulation + positive affect + effectiveness with objects + verbal effectiveness + average duration of an episode of looking at child + proportion of child's social expressions (smiles, vocalizes, gives, shows, offers, plays) to which mother responded appropriately (looks, smiles, plays, talks, takes; $M = 0.80$, $SD = 0.19$) within the same or next 10-sec period, in natural observations — difference between highest and lowest proportions of mother's responsiveness to child's social behavior for the six natural observations (i.e., responsiveness inconsistency) (panel only) ($r_{av} = .65$).

19. *Restricts child.* Number of 10-sec periods in which mother restrained + hit or reprimanded child + ratings of mother's negative affect + nonacceptance of child, in natural observations ($r_{av} = .57$).

20. *R to child's distress.* Proportion of child's distress signals (cries, negative vocal, negative gesture, clings) to which mother responded appropriately (attends need, holds, touches affectionately, gives, plays, etc.) within the same or next 10-sec period, in natural observations (panel only).

21. *Socializes.* Number of natural observations during which mother socialized (in person or on the phone) with an adult other than her husband or the observer + number of times mother initiated speech to unfamiliar mother in peer stranger probe, calculated from tape transcript (panel only) ($r = .50$).

22. *Reads versus watches TV.* Number of natural observations during which mother read, wrote, or performed some similar solitary activity — number of natural observations during which mother watched TV (panel only).

Results and Discussion

Discussion of the results of the study is divided into two parts: first, correlational relations among variables for the four samples combined and second, replication of correlations from one sample to another. In order to combine the results of the correlational analyses across the four samples, an additive method for combining probabilities suggested by Edgington (1972) and Rosenthal (1978) was used by applying the formula $P = \Sigma p^n/n!$, where P is the combined probability level, p is the probability level for each sample, and n is the number of samples (i.e., 4). When significant correlation coefficients for different samples were in opposite directions, the combined probability was considered to be nonsignificant; fortunately, this occurred extremely rarely (only twice). The significance levels for the four combined samples are indicated by asterisks in table 1.[3] The correlation coefficients for separate samples are given in table 2.

CORRELATIONAL RELATIONS

Relations among Child Variables

Variables in the study contain information about children's intelligence, language, and social relations. Previous research (Clarke-Stewart 1973; White & Watts 1973) and theory (Lewis & Cherry 1977; Lewis & Freedle 1973) suggest that these may all be related to each other. The model proposed by Lewis and

[3] This method is recommended for combining results from a small number of independent studies. Since the data sets here were not, strictly speaking, "independent," having been collected and analyzed by the same investigators on approximately the same population, some caution should be exercised in interpreting p values. To compensate for this nonindependence, two-tailed p values for individual samples were used and a relatively conservative significance level was adopted in the combined P value ($P \leq .05$, two-tailed).

TABLE 1

CORRELATIONS OF MATERNAL AND CHILD VARIABLES: SUMMARY

Variables	1	2	3	4	5	6	7	8	9	10[a]	11	12	13	14	15[a]	16[a]	17	18	19	20[a]	21[a]
Child:																					
1. Intelligence																					
2. Language level																					
3. Descrip. speech																					
4. Phys. attachment																					
5. Plays with M.																					
6. Interacts with M.																					
7. Stranger anxiety																					
8. Interacts w/str.																					
9. Interacts w/peer																					
10. Plays with O.																					
Mother:																					
11. SES																					
12. Intelligence																					
13. Accept. attitude																					
14. Describe speech																					
15. Language level																					
16. Language R.																					
17. Plays with C.																					
18. Interacts with C.																					
19. Restricts C.																					
20. R to distress																					
21. Socializes																					
22. Reads vs. TV[a]																					

NOTE.—p values for the four samples combined) two-tailed: *$P \leq .05$, **$P \leq .01$, ***$P \leq .001$. p values (for the 4 samples separately) two-tailed: · = p N.S., 0 = $p \leq .05$ for panel ($N = 14$), 1 = $p \leq .05$ for cohort 1 ($N = 30$), 2 = $p \leq .05$ for cohort 2 ($N = 35$), 3 = $p \leq .05$ for cohort 3 ($N = 31$); italic numbers = $p \leq .01$, boldface numbers = $p \leq .001$.

[a] Variables available for panel sample only. (The reason some measures were not available in the replication sample was that the major purpose of the replication assessments was program evaluation not replication, and therefore only a selected subset of measures was collected or coded for these subjects.)

TABLE 2

CORRELATIONS OF MATERNAL AND CHILD VARIABLES; SEPARATE SAMPLES

PANEL / COHORT 1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1. Intelligence		.35	.18	-.05	.03	.15	.07	.07	.07		.24	.17	.11	.30			.24	.22	-.32		
2. Language level	.53		.35	.08	.08	.43	.45	-.08	.01		.32	.18	.17	.37			.23	.21	-.18		
3. Descrip. speech	.22	.71		-.28	-.25	.11	.06	-.19	.04		-.19	-.25	.08	.11			.19	.08	-.00		
4. Phys. attachment	-.03	.32	-.28		.38	.38	.03	.09	.12		.05	.31	.05				.27	.45	.14		
5. Plays with M	.36	.08	.08	.28		.46	.03	.26	.21		.24	.34	.01	.29			.75	.37	.04		
6. Interacts with M	.26	.41	.35	.59	.46		.19	.19	.45		.33	.34	.17	.27			.56	.62	.20		
7. Stranger anxiety	.19	-.33	.37	.32	.21	.45		.13	.09		-.30	-.16	-.17	.37			.15	.08	.09		
8. Interacts w/str.	.03	.40	.05	-.13	-.19	.03	.03		.25		.03	-.16	-.14	.09			.20	.21	.29		
9. Interacts w/peer	.10	.23	.21	-.36	.48	.19	-.19	.19			.38	.06	-.06	.03			.12	.33	.19		
10. Plays with O	.42	-.06	.23	.03	.19	.51	-.26	-.13	.09					.08							
11. SES	.19	.26	.30	.09	.18	-.19	.51	.25	.25	.04		.39	.04	.09			.36	.15	-.50		
12. Intelligence (M)	.15	.17	.56	.44	.24	.10	-.46	.38	-.33	-.09	.71		.35	.27			.18	.37	-.09		
13. Accom. attitude	.21	.66	.39	.30	.34	.34	.24	.21	-.06	-.01	.70	.65		-.11			.35	.23	.29		
14. Descrip. speech	.32	.18	.66	.31	.42	.42	-.08	.66	-.05	.03	.54	.28	.53				.35	.17	-.20		
15. Language R	.48	.96	.16	.27	.18	.18	.36	.54	-.04	.07	.43	.33	.74	.22							
16. Language level	.17	.04	.66	.01	.46	.48	.05	.55	.34	.10	.09	.29	.69	.26	-.01						
17. Plays with child	.53	.46	.27	.30	.15	.66	.39	-.19	.07	.53	.63	.53	.69	.55	.42	-.07		.45	-.28		
18. Interacts with child	.30	.50	.18	.53	.37	.88	-.03	.37	.51	.33	.35	.44	.40	.53	.57	.02	.69		.09		
19. Restricts child	.28	.24	.07	.04	.44	.11	-.33	.66	.19	-.40	-.31	.27	.01	.19	.25	.05	-.20	.14		-.05	
20. R to distress	.21	.07	-.25	-.01	.61	.21	.13	.15	.35	.09	.37	.55	-.28	.20	.06	.12	.42	.28	-.19	.17	
21. Socializes	.06	-.36	-.16	-.34	.50	-.04	-.04	.22	-.05	.12	.36	.07	-.17	.19	-.37	.09	-.59	.52	-.42		-.51
22. Reads vs. TV	.11	-.16	-.16	.51	.25	.50	-.28	.08	-.45	.56	-.16	.22	.25	-.21	-.17	-.21	.60	.30	-.35		

COHORT 2 / COHORT 3

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Intelligence		.51	-.09	.03	.45	.42	-.21	.24	-.11		.29	.01	.12	.45			.35	.27	-.21
2. Language level	.48		.09	-.24	.09	.33	-.12	.30	.17		.18	.10	.18	.13			.08	.14	-.09
3. Descrip. speech	.44	.34		.33	-.23	.05	-.32	.07	.04		.19	.08	-.08	-.06			-.25	.02	.17
4. Phys. attachment	-.14	-.04	.06		.13	.35	-.26	-.14	.25		-.03	.13	.01	-.17			.26	.37	.06
5. Plays with M	.17	-.01	.28	.27		.42	-.14	.44	.11		.43	.47	.48	.54			.79	.49	-.35
6. Interacts with M	.34	.17	.07	.21	.14		.02	.23	.39		.23	.20	.27	.42			.54	.84	.33
7. Stranger anxiety	-.18	.07	-.13	-.06	-.04	.14		-.45	-.07		-.08	-.31	-.09	.16			.08	-.03	.11
8. Interacts w/str.	.30	.20	.35	-.42	-.20	.08	-.13		.12		.11	.21	.32	.19			.45	.36	.17
9. Interacts w/peer	.08	.06	.12	-.18	.07	.08	.36	.27			.24	.23	.04	-.05			.03	.22	-.37
11. SES	.13	.03	-.04	.05	-.07	.07	.03	.15	.30			.21	.06	.45			.37	.28	-.28
12. Intelligence (M)	.32	.11	.05	.06	.36	.03	-.08	.26	-.20		.45	.23	.37	.65			.45	.30	-.36
13. Accom. attitude	.06	.00	-.06	.06	.00	-.26	.02	-.22	.39		.35	.53		.24			.37	.19	-.14
14. Descrip. speech	.44	.33	.52	.18	.34	.37	.06	.31	.07		.24	.14	.15				.35	.45	-.41
15. Language R	.18	.10	.19	.27	.72	.20	.03	.11	.01		.15	.21	-.15	.32				.35	-.28
16. Language level	.17	.05	.09	.42	.27	.74	-.14	.10	.02		.05	.39	.18	.26			.20	.57	-.27
17. Plays with child	-.21	-.08	.15	.05	.33	.04	.11	-.07	.03		-.17	-.42	.21	.04			.08	-.23	

Note.—For panel (N = 14), p ≤ .05 = .53; p ≤ .01 = .66; p ≤ .001 = .78 (two-tailed); for cohort 1 (N = 30), p ≤ .05 = .35; p ≤ .01 = .45; p ≤ .001 = .55 (two-tailed); for cohort 2 (N = 35), p ≤ .01 = .42; p ≤ .001 = .52 (two-tailed); for cohort 3 (N = 31), p ≤ .05 = .35; p ≤ .01 = .45; p ≤ .001 = .55 (two-tailed). p ≤ .05 = .33; p ≤ .01 = .45; p ≤ .001 = .55 (two-tailed).

Freedle, positing that language, cognitive, and social development are not three separate domains but three related aspects of an individual's unified development, is appealing but, unfortunately, does not offer guidelines about what variables might best represent the three aspects of development. Since more than one index of each was available in the present study, the first step was to investigate correlations *within* the three aspects.

In the area of the child's language, the measure of ability was significantly correlated with speech that described objects or people— a relation receiving confirmation from other investigations where talking about persons and things has been observed to be part of mature language for 2-year-olds (Moerk 1975; Nelson 1973).

In the area of social relations, correlational analysis of relations among the variables assessing the child's relation with mother—interaction with mother in the natural observations, play with mother in the semistructured play situations, and physical attachment to mother in both natural and probe situations—revealed significant associations between natural interaction and both play and physical attachment (the latter relation replicating Clarke-Stewart's [1973] observations of 1–1½-year-olds). Among measures assessing the child's social behavior with people other than mother, verbal and physical behavior toward adult female strangers was correlated, as was social interaction with 2- and 3-year-old peers, but no significant correlations were found between the child's reactions to these different categories of strangers or a somewhat familiar observer (see Lewis & Brooks 1974; Durfee & Lee, Note 2). Nor were these measures of sociability to a stranger related to the child's relation with the mother, a lack of association receiving support from prior findings of Schaffer and Emerson (1964) for intensity of attachment and fear of strangers, Clarke-Stewart (1973) for physical attachment and responsiveness to strangers, and Lieberman (1977) for sociability to mother and stranger and interaction with an unfamiliar peer.

In addition to looking for relations within the three aspects of child development, significant associations were sought between domains. Intelligence was found to be highly correlated with language level, and both were associated with the child's interaction with mother. Since some measures of language skill are included in intelligence tests and the association between intellectual development and the child's interactive relation with mother has been observed before (Clarke-Stewart 1973; White & Watts 1973; Lewis, Weinraub, & Ban, Note 3; Beckwith, Note 4), these relations are hardly surprising. Intelligence and language were not, however, related to physical attachment to mother or to interaction with strangers (see also Clarke-Stewart 1973; Lewis et al., Note 3, for boys; Matas, Note 5). For the subjects and variables in the present study, therefore, support for the Lewis and Freedle model of interconnected aspects of development exists only if one takes the following as indices of the three domains: IQ for cognition, mean length of utterance for language, and interaction with mother for social development. The child's speech content, physical attachment and play with mother, and sociability to strangers were not part of a "unified development" cluster.

Relations among Maternal Variables

The literature on mother-child interaction is replete with studies documenting statistical relations between maternal characteristics and family social status (see Clarke-Stewart 1977). In the present study, also, SES was related to mothers' child-rearing behavior. Higher SES was found to be associated with speech to the child that was descriptive rather than directive, play that was positive and responsive, and interaction that was not restrictive—relations observed, in part, by Bayley and Schaefer (1960), Beckwith (1972), Cohen and Beckwith (1976), Lytton (1976), Nelson (1973), and Zegiob and Forehand (1975). A closely associated correlate of SES, mother's IQ, demonstrated even stronger relations with these positive maternal behaviors and, in addition, was associated with the frequency and responsiveness of the mother's interaction and her verbally expressed accommodating attitude toward discipline.

The major cluster of maternal measures revealed in the data-reduction analysis in this study comprised multiple aspects of the mother's positive social interaction with the child. Significant correlation coefficients were obtained among all measures of positive interaction in the natural observations; the only behavior categories missing were maternal restrictiveness and responsiveness to distress. This interaction variable closely parallels the intercorrelated cluster observed by Beckwith (1972) and the "optimal maternal care" factor identified by Clarke-Stewart (1973) for mothers of 9–18-month-olds. Both these studies, as well as another by Hanson (1975), concur in finding that mothers'

restrictiveness was not part of the positive interaction cluster. The Clarke-Stewart study, however, unlike the present one, found contingent responsiveness to distress to be part of "optimal care"—probably because crying and fussing were more common, salient, and significant signals at that preverbal age.

The interaction variable was significantly correlated with independently assessed indices of language level and content and play quality. The first of these relations, too, is confirmed in the Clarke-Stewart (1973) study, in which mothers whose speech was predominantly referential (i.e., descriptive) interacted with their children more.

Relations between Maternal and Child Variables

Child's intelligence.—Studies relating child development to parental status or ability are common (see reviews by Clarke-Stewart 1977; Deutsch 1973) and often demonstrate statistically significant relations between children's IQ and parents' IQ or SES. More useful for understanding children's intellectual development, however, are studies that have compared the predictive power of SES or parental IQ with features of the child's immediate environment. Such studies have found that maternal behaviors like the following are more predictive of children's intellectual development from 1 to 3 years than are demographic variables of occupation, education, or IQ: provision of play materials (Bradley & Caldwell 1976; Clarke-Stewart 1973; Elardo, Bradley, & Caldwell 1975; Bradley, Caldwell, & Elardo, Note 6); positive affect and nonrestrictiveness (Clarke-Stewart 1973); responsiveness (Clarke-Stewart 1973; Bradley et al., Note 6); and language teaching, modeling, or stimulating (Clarke-Stewart 1973; Hanson 1975; Wachs, Uzgiris, & Hunt 1971). These maternal qualities have also consistently been found to be correlated with children's intelligence in studies that did not contrast them with demographic predictors (Beckwith 1971a; Beckwith et al. 1976; Engel, Nechlin, & Arkin 1975; Wenar 1976; White & Watts 1973; Carew, Chan, & Halfar, Note 7). Like these previous studies, the present study found that children's intelligence was more closely correlated with the mother's behavior—descriptive speech, positive play, nondirectiveness and nonrestrictiveness—than with her IQ or SES (which were not significantly correlated with child's

IQ). Children's intelligence was not related to maternal attitude, responsiveness to distress, adaptation of language to the child's level (language R or language level), or personal activities. Other studies also confirm this lack of a relation between IQ and maternal attitude (Clarke-Stewart 1973; Jordan & Spaner 1972), language (Engel et al. 1975), and responsiveness to distress (Clarke-Stewart 1973).

Child's language.—As children begin to understand and use language, the amount they vocalize and the size of their vocabularies are related to maternal speech and behavior (see review by Clarke-Stewart [1977] and more recent studies by Elardo et al. [1977], Engel et al. [1975], and Carew et al. [Note 7]). In the present study, two other measures of children's language were examined: level and content. The child's language level was most highly correlated with the mother's language level to the child. It was also correlated to a lesser extent (in two samples only) with the mother's nondirective speech. Other research supports these findings, showing that mothers speak to less verbally competent children in shorter sentences, using fewer questions and more directives (Bloom, Rocissano, & Hood 1976; Cross 1977; Harkness 1977; Nelson 1973; Phillips 1973; Reichle, Longhurst, & Stepanich 1976; Glanzer & Dodd, Note 8; Starr, Note 9).

The issue that still is not settled is how finely "tuned" the mother's speech is to the child's level of comprehension and production (see Bloom & Lahey 1978). Is it, as has been suggested, that a mother's speech is closely matched to her child's but slightly more complex? And, if so, how much more complex? Although mothers differentiate in sentence length and syntactic simplicity in their conversations with children and adults and among children of different ages (Cross 1977; Newport, Gleitman, & Gleitman 1977; Phillips 1973; Reichle et al. 1976), is there a match when gross age differences are eliminated? Newport et al. (1977) found no significant relation between mother's and child's MLU when children's age and ability were partialled out, while Harkness (1977) did find such a relation. In the present study, the children were all the same age when their language was assessed, so age differences were not an issue. The finding that the MLUs of mother and child were both very highly correlated[4] and only slightly

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[4] This correlation was particularly significant since the child's MLU was assessed in conversation with a stranger independent of the mother's conversational influence that may have colored the results of other mother-child language studies.

different in length (the mother's mean MLU to the child was, on the average, 1.5 [SD = 0.9] words longer than the child's to her) appears to support a fine-tuning hypothesis. However, the differences between MLUs for mother-child pairs ranged from 0.1 to 3.7 words/utterance, and it was also true that children's MLU was highly correlated with the amount by which their mother's MLU exceeded theirs (see also Cross 1977). This finding indicates that fine tuning may not have a simple monotonic effect. Taken together, these two relations suggest that—within the limits observed in this sample (differences of 0–4 words/utterance or, more narrowly, 0.5–2.5 words/utterance, the range for 11 of the 14 subjects)—it may be better for children's language development if maternal speech is not too closely matched to the child's level.[5]

Implicit in the fine-tuning hypothesis is also the suggestion that the mother systematically adapts her speech to the child's level from her usual level to an adult. In the present study, although for all mothers sentences to the children were shorter than to an adult interviewer, no correlation between the child's MLU and the amount by which the mother reduced her sentence length to the child was observed. Nor was the child's language level related to the mother's contingent responsiveness to the child's vocalizations or to the amount the mother talked to the child in natural observations—two other factors that might be expected to contribute to children's language development.

Several studies have attempted to find out whether the content of children's early speech is related to what their mothers talk to them about. Evidence from these studies suggests that when mothers' talk is predominantly about things children's language reflects a parallel emphasis on things in early vocabulary and conversation with the mother (Clarke-Stewart 1973; Moerk 1975; Nelson 1973; Baldwin, Note 10). In the present study, the content of the mother's speech to the child was examined in relation to the child's speech to a stranger. Although mean values for the proportions of descriptive speech were equivalent for mothers and children (34% and 36%, respectively), for only one of the four samples was the obtained correlation coefficient between maternal and child speech content statistically significant. This suggests that the significant relations observed in previous studies more likely reflect mutuality of content in mother-child conversation than that the child adopts the mother's language style.

Child's relationship with mother.—Most recent research on mother-child relations has documented associations between maternal behavior and the security or quality of the child's attachment to the mother (Ainsworth 1973; Clarke-Stewart 1973; Matas, Note 5; Ainsworth, Note 11; Tolan & Tamasini, Note 12). In the present study, maternal behavior was found to be related to three other aspects of the child's relation with mother. The first of these variables, amount and responsiveness of social interaction in natural observations, was most strongly and consistently related to the maternal variable "interacts with child," clearly reflecting mutual interaction and matched interactive behaviors on the part of mother and child. Such a relation has been consistently observed in other studies (Beckwith 1971; Clarke-Stewart 1973; Lytton 1976; Seegmiller, Note 13) and is one that follows naturally and inevitably from the nature of reciprocal interaction and its assessment. In families where mother-child interaction was frequent, the mother also played more positively and responsively with the child and interacted less with other adults (in the same or other situations). It has been previously noted that the amount of mother-child interaction during natural observations decreases when the father is present (Clarke-Stewart 1978; Lamb 1978); the finding in the present study supports that observation for other adults as well.

The second variable, play with mother in semistructured situations, was, not surprisingly, most strongly associated with the quality of the mother's play in the same situations, but it was also related to her SES, IQ, nondirective speech, nonrestrictiveness, and her natural interactions with the child, particularly her responsiveness to the child's social expressions. Some support for this pattern of associations is provided by Beckwith's (1972) observation that younger children (8–11 months) engaged in less frequent and responsive social play with mother when mother was critical, suppressive,

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[5] Another suggestion might be that mother's MLU should (or does) exceed the child's proportionally more as the child's MLU increases (i.e., for example, when the child is able to use 1-word utterances, the mother should speak in 1-word utterances; when the child typically uses 2-word utterances, the mother should speak in 2.5-word utterances; and when the child uses 3-word utterances most commonly, the mother should speak in 4-word utterances).

and interfering, and by Bishop's (1951) observation that older children (3–6 years) were more noncooperative and negative in play with mother when mother was directive and nonaccepting. Beckwith did not find that play with mother was related to mother's education, but, as all her subjects were middle class, the range of educational levels represented may have been too narrow to reveal a significant relation.

Finally, the third variable, physical attachment in natural and probe situations, was related only to the frequency of mother-child interaction in the natural observations. This relation finds support in Schaffer and Emerson's (1964) study of infants up to 18 months. They also found that intensity of attachment was related to the amount of interaction with mother but not to her SES or IQ. The one difference between the two sets of results was that Schaffer and Emerson found physical attachment to be related to the mother's responsiveness to distress. This relation was not observed in the present study, probably, as we have suggested before, because this maternal variable becomes less important as, with age, children's distress becomes a less salient communication signal.

Children's interaction with strangers.—Until recently, most studies of children's reactions to adults outside the family have focused on the development of "stranger anxiety." In the present study of 2-year-olds, stranger anxiety was not found to be significantly related to any maternal variable. More interesting and significant were the correlations found with children's *positive* interactions with strangers. Willingness to interact with an adult stranger was correlated with the mother's accommodating attitude, interaction with the child (positively), and socializing with other adults (negatively). Beckwith (1972) also found with younger children that children's initiation and responsiveness to an unfamiliar woman was related to the mother's verbal and responsive interaction with the child and her attitude toward discipline. The finding from these two studies suggests that the child's sociability with an adult stranger depends on or is reflected in sociable interaction with mother, rather than being learned by

watching the mother "model" social behavior with her adult acquaintances.

Another measure of children's social interaction with strangers was the child's willingness to play with the observer in a semistructured play session. This variable was related to the mother's play style and activities during the natural observations. The child whose mother played with him in an active and responsive way was more likely to participate in a similar play session with a stranger. The child was less likely to participate in play with the observer if the mother watched TV during the observations; when the mother spent her time during the observation reading or writing, however, this was associated with the child's playing more with the observer. It may be that when the mother was busy with her own work during observations the child paid more attention to the observer and so was more willing to interact with her later, whereas when mother watched TV the child would also watch TV and so ignore the observer. It might even be speculated that when the child often saw his mother reading or writing these activities—the observer's stock-in-trade—would appear worthwhile and so enhance the observer's value in the child's eyes.

The child's sociability to an unfamiliar peer was not significantly related to any maternal variable. It seems reasonable that this kind of social interaction would be related to the child's experience outside the mother-child dyad, experience involving other children. Results of the present study suggest that while generalization of children's interactive skills from mother to an unfamiliar adult may occur, generalization from mother to another child is not likely.

REPLICATION

The purpose of the second part of the present study was to examine the replicability of relations across the four separate samples in the study (panel and three replication cohorts). Sixteen variables were available for both panel and replication samples, providing a total of 120 relations to examine for replicability.[6] The patterns of correlations for each of these relations were examined in terms of the sig-

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[6] Using regression coefficients rather than simple correlation coefficients would have increased the likelihood of finding replicable statistical relations in these data. The reason this strategy was not followed here was in order to maximize comparability between our findings and previous investigations of mother-child relations, which have nearly always been at the level of simple correlations.

nificance ($p \leq .05$) or nonsignificance ($p >$ .05) of the sample r's. (See table 2 for p values for the four samples.) The choice to discuss replicability solely in terms of significance level was based on the relatively standard use of this —admittedly arbitrary—criterion in interpreting correlations obtained in studies of mother-child interaction. It is of course possible that other, less stringent, approaches to the issue of replicability might yield more encouraging results.

Of the 120 relations calculated, 58 reached statistical significance for at least one of the four samples. Only five of these relations were replicated by all four samples! Thirteen were replicated by three out of four samples; 14, by two of the four samples; and for 26 significant sample r's there was no replication by another sample. If replicability of relations is important, these figures might discourage any investigator of mother-child interaction and would strongly suggest that generalizations from small sample studies of mother-child relations be drawn with extreme caution. If replicability is sought between any two samples, these data suggest, the chance of replicating any single significant correlation is only 32%.[7]

Apparent replicability could be increased by including as variables methodologically confounded measures like physical proximity *and* contact (cf. Masters & Wellman 1974), or looking, talking, *and* playing. The correlations among these sets of measures were indeed highly replicated in the data-reduction analysis. But, as far as possible, the variables included in the present analysis were selected to be methodologically independent. Relations between the only variables that were not independent—mother's interaction with the child and child's interaction with the mother, and mother's and child's play styles—as expected, were completely replicated, attaining highly significant r's in all four samples. But including associations between methodologically connected variables is not informative about mother-child relations. To learn more about such relations, we explored some hypotheses to account for the discrepancies in r's obtained in the different samples and the differences in replicability of different relations. These hypotheses are discussed next.

With a p level $\leq .05$, and 120 relations, 6 r's in each sample would be expected to be significant by chance. For four samples, therefore, 24 r's would be significant by chance—almost exactly the number of nonreplicated relations, in which the r of only one of the four samples was significant. The question is, what distinguishes these relations from those where r's were replicated across samples? One possibility in the present study was that lack of replication was the result of using variables that were not identical for the panel and replication samples. Since IQ variables based on different standardized tests and interaction variables based on 2 versus 6 hours of observation and slightly different sets of measures entered the relations that were completely replicated, however, while measures of language, play with mother, stranger anxiety, and maternal attitude that were assessed and coded by the same research assistants and combined to form identical variables underlay relations which were completely nonreplicated, this explanation is not adequate to account for the lack of replication.

A second hypothesis to account for replicability was that highly replicated correlations were more statistically significant than unreplicated correlations. For both highly replicated (in three or four samples) and nonreplicated relations, however, the proportion of correlations significant at $p \leq .01$ was about the same, suggesting that the level of significance did not account for the degree of replicability of different relations.

A third hypothesis about replicability was that replicability decreased with smaller sample size. This hypothesis was examined within the somewhat narrow limits offered by the four samples in the present study (N's = 14, 30, 31, 35). No support for the hypothesis was found. The number of nonreplicated r's was equivalent whether the sample contained 30 subjects or half that number. Therefore, sample size did not seem to be a requirement for replication in the present study. Increasing sample size substantially would undoubtedly increase replicability of correlations (see Masters & Wellman 1974)—but not within the small-sample n's that

[7] Number of completely replicated relations (replicated by all 4 samples) + Number of relations replicated by 3 of the 4 samples $\times$ 2/3 + Number of relations replicated by 2 of the 4 samples $\times$ 1/3 $\div$ Total number of relations with a significant r for at least 1 sample

$$5 + 13 \times 2/3 + 14 \times 1/3 \div 58 = .32$$

are common for intensive studies of mother-child interaction.

Mean differences between samples offered a fourth hypothesis to account for differences in the degree of replicability; perhaps replication was not attained because samples were not really drawn from the same population. This hypothesis was explored by calculating and testing differences among means of variables in the three replication cohorts (see means and statistics in table 3). All relations involving the 10 variables for which significant mean differences were found were than examined to see whether the order of magnitude of r's paralleled the order of magnitude for means,[8] and whether the significance level of r's matched the homogeneous subsets formed according to the ranges of the means. Only nine of the correlational patterns examined followed the same order as the means and differed in significance level according to the grouping of homogeneous subsets. It was not possible to include the panel sample in the ANOVA of means because of differences in coding, variable composition, and input format. However, patterns of r's including all four samples were examined for correlations with SES, a variable on which the panel was known to be higher. This examination further supported the findings for the three replication cohorts: None of the 15 correlational patterns examined paralleled the ordering for SES level (panel > cohort 3 > cohort 2 > cohort 1). One further test of the effect of sample differences on replication was to look for relations in which the panel r was nonsignificant and r's for all three replication cohorts were significant. Only one (out of 50) relation followed this pattern. Taken together, then, the results of these examinations offer strong evidence that sample differences did not account for correlational differences.

One other evaluation of this hypothesis was carried out by looking at samples that differed in composition by sex. The entire replication sample ($N = 96$) was divided into four groups (N's = 24 each)—odd- and even-numbered boys and odd- and even-numbered girls—and variables were correlated for each of these four groups separately. Although a sizable number of correlational differences between male and female groups resulted, the differences were seldom replicated by both groups of both sexes. If a significant correlation was replicated by both groups of one sex, it was typically also

TABLE 3

ANALYSIS OF VARIANCE FOR THREE REPLICATION COHORTS

VARIABLES	MEAN				HOMOGENEOUS SUBSETS OF COHORTS[a]	
	Cohort 1	Cohort 2	Cohort 3	F		
Child:						
Intelligence	43	47	49	2.50	1,2,3	
Language level	787	949	985	6.01**	1	2,3
Descrip. speech	359	304	330	1.47	1,2,3	
Phys. attachment	66	346	301	16.60***	1	2,3
Plays with M	147	201	193	12.39***	1	2,3
Interacts with M	148	188	214	5.61**	1,2	2,3
Stranger anxiety	116	545	293	7.84***	1,3	2,3
Interacts w/str.	244	322	336	2.02	1,2,3	
Interacts w/peer	230	162	183	1.76	1,2,3	
Mother:						
SES	247	262	305	3.64*	1,2	2,3
Intelligence	217	214	218	.27	1,2,3	
Accom. attitude	517	680	886	5.25**	1,2	2,3
Descrip. speech	112	150	178	1.14	1,2,3	
Plays with C	756	810	803	5.73**	1	2,3
Interacts with C	632	723	761	4.30*	1,2	2,3
Restricts C	153	124	64	4.29*	1,2	2,3

[a] Subsets of cohorts the highest and lowest means of which do not differ by more than the shortest significant range for a subset of that size (Scheffé procedure).

* p (2,92) $\leq$ .05.
** p (2,92) $\leq$ .01.
*** p (2,92) $\leq$ .001.

[8] Actually, in order to compensate for differences in sample size, p values rather than r values were used for this comparison.

significant for at least one of the groups of the other sex. Of the total of 120 relations, only six were significant ($p \leq .05$) for both groups of one sex and nonsignificant for both groups of the other sex; and of these six, four were close to significant ($p \leq .10$) for one of the nonsignificant groups. The two relations that were replicably different for boys and girls were between child's stranger anxiety and interaction with peer (significantly negative for girls, not correlated for boys) and mother's directive speech and interaction with child (significantly correlated for boys, not significant for girls). Analysis of variance for sex performed on these variables showed none of them to be significantly different in mean level for boys and girls.[9] These results support the previous finding that differences in correlations were not likely to be due to sample differences and, furthermore, suggest that many of the sex differences reported in the literature on mother-child interaction are the result of replication by any second group of subjects rather than necessarily by a group of the opposite sex.

The last hypothesis that was explored in the present study in an effort to account for replicability was that replicated relations were more often predictable on the basis of previous research or theory. Using the literature reviewed in the first part of this article and extrapolating from common sense and psychological theory as well, it was possible to predict all of the completely replicated relations, nearly all of the relations replicated by three of the four samples, and only about one-fifth of the relations that were not replicated. Of the hypotheses "tested," then, this last one seems to offer the most explanatory power to account for degree of replicability observed in mother-child relations in the present study. Its success demonstrates in an empirical way the value of a thoughtful and informed context for interpreting significant correlations found in single samples.

Finally, the replicability of different relations in the present study was examined to see which variables were most consistently predictive and which relations were most highly replicated. A tally was made for each variable of the number of relations it entered at each of three levels of replicability (correlated in three or four; two; or one sample). The tally was then converted into proportions of the total

number of significant relations observed for each variable. Comparing the distributions of proportions for the set of variables revealed that the three most highly replicated variables were child interacts with mother (43% were highly replicated vs. 0% nonreplicated), mother's IQ (50% vs. 17%), and mother plays with child (50% vs. 6%). These variables contrasted with those that were least replicated: attitude, descriptive speech, and interaction with strangers. The latter variables were found disproportionately among the nonreplicated correlations (e.g., 68% of all correlations with stranger variables were nonreplicated) and less among the highly replicated correlations (e.g., none of the correlations with stranger variables were highly replicated); they contributed to over half the nonreplicated relations observed. (All other variables were relatively evenly distributed over the three replication categories or appeared most frequently in the middle one.) It seems likely that one reason for the difference between these two sets of variables is methodological: the set of highly replicated variables was based on standardized tests, extensive, multimeasure observations, or multidimensional ratings; the nonreplicated variables were based on single assessments of less complex, quantitative measures. Unfortunately, information was not available about the reliability, stability, and validity of these latter measures (while the former variables were known to be relatively reliable and stable); these factors, too, may have affected the replicabilities observed.

Examining the particular relations that were most highly replicated indicated also that nearly all were between pairs of variables within the same domain or at the same level (e.g., interaction with mother, intellectual level, demographic characteristics, or verbal performance). To increase replicability, therefore, investigators might create and examine chains of correlations, across the range of levels assessed, rather than correlating directly variables at widely discrepant levels or in separate domains (e.g., child's IQ and mother's attitude, or child's language and mother's interaction).

Conclusion

The present multidimensional study of mother-child relations in 2-year-olds revealed patterns of maternal, child, and mother-child correlations that were parallel to or reasonable

extensions of those found with younger children by Clarke-Stewart (1973). Measures of children's competence across developmental domains of cognition (IQ), language (MLU), and social relations (positive interaction with mother) were intercorrelated and were associated with a cluster of stimulating and interactive maternal behavior including positive and responsive interaction with the child, and complex, descriptive, and interrogative language to the child. They were not related to the mother's IQ or SES. Besides replicating these findings related to children's competence, the present study offered information about children's sociability—to mother, observer, adult strangers, and peer strangers. No general sociability factor appeared in the data relating children's interaction with these varied categories of partner; sociability variables were not intercorrelated nor were they related to the same maternal variables. Stranger anxiety and interaction with an unfamiliar peer were not related to any maternal variable; interaction with an adult stranger was related to mother's attitude, language level, interactiveness with the child, and socializing with other adults (negatively); play with the observer was related to whether the mother read or watched TV during observations; and play with mother—the most predictive child variable of all—was related to mother's SES and IQ, nondirective speech and nonrestrictiveness, playfulness and responsiveness.

Using four different samples to investigate mother-child relations allowed us to explore the replicability of individual r's in each sample. The results were notable for the lack of replication they revealed. Not only, as has always been cautioned, is it impossible to predict from relations observed in groups of subjects to individuals, it is also, these results suggest, difficult to predict to other, even similar, samples. The chance of replicating any given r in the present study as significant or nonsignificant was only one in three. Clearly, nonreplicated correlations in the present study—or, perhaps, in other small-sample research on mother-child relations—lacking robustness and generalizability, offer a weak empirical basis for designing programs and making policies to foster young children's development. In fact, if the results of the present investigation are any indication, the relations of particular interest for early childhood or parent-education policies—prediction of children's intellectual abilities from mother's attitudes or behavior—are especially unlikely to be replicated.

Replication in the present study was not improved by setting a higher significance level ($p \leq .01$) and did not seem to be related to differences in measures or between samples (in sex, size, or means). We need more replication studies by the same investigators on the same populations rather than by other investigators on different samples, in different places, at different times, and using different instruments, before we can attribute differences in results to differences in populations. In the meantime, given the temporal and economic constraints on doing this kind of intensive research, it might be helpful for investigators to divide their samples randomly in half prior to correlational analysis in order to assess the replicability of their obtained correlations (split-half reliability). The best strategy for maximizing replicability found in the present study was prediction from prior research or theory. Clearly, as all would agree, this is an important step in interpreting the results of correlational studies of mother-child interaction and one that should not be suspended when an investigator discovers an unexpected correlation—no matter how fascinating its implications. Our exercise in replication raised more questions than it answered about the results of correlational studies of mother-child interaction. Our final conclusion, therefore, must be that interpretation of statistically significant correlations between maternal and child variables be undertaken with caution until the issues of replication and replicability are explored and resolved in future research on mother-child relations.

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