ABSTRACT
                  This study was designed to examine the nature of
nonverbal social interaction between mothers and infants and to
compare various situational effects. A total of ten 3-month-old twin
infants (five male and five female) and their mothers were videotaped
in their homes during free play, bottle feeding and spoon feeding
situations. A repeated measures design was employed, accumulating 48
sessions of each activity. Analyses of correlation matrices between
total gazing time, gazing frequency, and total session time indicated
that play produced a stronger relationship among the variables than
the task-oriented feeding activities, with mother total looking time
correlated with infant avoidance. The data provide strong evidence
that situation variables have a significant influence on social
gazing during mother-infant interaction. (Author/JMB)

EFFECTS OF DIFFERENT SITUATIONS ON MOTHER-INFANT GAZING

J. Craig Peery

Utah State University

EFFECTS OF DIFFERENT SITUATIONS ON MOTHER-INFANT GAZING

Correlation matrices between total gazing time, gazing frequency,
and total session time for gazing behavior of 10 three-month-old twin
infants (five male and five female) and their mothers during play,
bottle feeding and spoon feeding activities were analyzed. A repeated
measures design was employed accumulating 48 sessions of each activity.
Video-tape equipment was used in the home, data were gathered as naturalistically
as possible. Play produces a stronger relationship than the task-oriented
feeding activities among the variables, with mother total looking time
correlated with infant avoidance. The data illuminate the nature of the social
interaction between subjects, and provide strong evidence that situation
variables have a significant influence on social gazing during mother-infant
interaction.

EFFECTS OF DIFFERENT SITUATIONS ON

MOTHER-INFANT GAZING

Within the last decade, gazing has emerged as the most frequently
researched modality of non-verbal communication. Much of this research
literature has been reviewed by Argyle and Kendon (1967), Duncan (1969),
Ellsworth and Ludwig (1972) and Argyle and Cook (1975).

Infant gazing is of particular importance because the infant's
visual system is the first social system to mature. A three- to four-
month old infant is capable of discriminating not only the direction
of his gaze, but the gaze direction of adults in contact with him; and
of participating with the adult in making stochastically predictable
changes in gaze direction resulting in a gazing dialogue, the mathematical
properties of which conform to a Markov process and are precisely similar
to those used in adult vocalizing and speech behavior (Jaffe, Stern &
Peery, 1973). Because of the importance of social gazing to the infant
some measure of gazing is often made by investigators studying infants'
social interaction. Unfortunately, there is little uniformity (and therefore
little comparability) in the gazing measures employed by different
investigators. Gazing frequency (Osofsky & Danziger, 1974), percent of
total session time spent gazing and mean and median gaze duration (Peery
& Stern, 1975), and mean number of seconds spent gazing (Ban & Lewis, 1974),
have all been used.

Previous studies with both adults and infants all share this common
weakness: the measures used to analyze the gazing process reveal little
or nothing about the social nature of the interaction under investigation.

The majority of the studies of gazing have used <u>mean gaze duration</u> or
<u>total gazing time</u>, individually, as the only reported measures. The fact
is, mean gaze duration doesn't tell much about what is taking place in any
given interaction. The present study demonstrates the power of using
correlations between Total Session Time, Total Gazing Time, and Gazing
Frequency to illuminate the nature of nonverbal social interaction between
subjects and to compare different situations.

METHOD

Gazing behavior of 10 three-month-old twin infants (five male and
five female) and their mothers during play (free social interaction with no
other motivation than itself); bottle feeding (the epoch when the nipple is
in the infants mouth and the sucking activity is continuous); and spoon
feeding (the epoch when the main focus of the mother is to feed the infant
by means of a spoon, and the feeding activity is continuous) activities
were analyzed. Video-tape equipment was used in the home. A repeated measures
design was employed. Five sessions of each activity were recorded for
eight of the ten mother-infant dyads, four sessions were collected for the
other two of the dyads for a total of 48 sessions of each activity (only
45 sessions of spoon feeding were recorded because of the failure of three
dyads to spoon feed on a given day); Visits were made weekly during the
infants' fourth month of life. An attempt was made to preserve ecological
validity by interfering as little as possible with subjects. A timed record
was made for each member of the dyad of each <u>gaze at</u> and <u>away from</u> the other's
face during each of the activities. As the terms <u>gaze at</u> or <u>look</u> are used
they should be understood to mean <u>looking at the face</u> of the partner in the

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in the dyad.   To distinguish between gazes at and gazes away from with a

minimum of awkward phraseology, the terms look and not-look (or away) are

used. Two trained observers achieved a 96 percent agreement as to the

occurance of a gaze and a 93 percent agreement as to its duration ± .6

seconds.   Further details on subjects and data collection have been reported

elsewhere (Peery & Stern, 1976).

Definitions

    Total Session Time (TST) means the period during which the dyadic

interaction occured, and for which data were recorded. The power for

determining the length of the ineraction was exclusively the mothers',

but their decisions were often influenced by screaming or sleeping infants.

Mother Total Looking Time (MTLT) means the amount of looking time occuring

during the session for the mother. Mother Total Away Time (MTAT) is the

amount of time during the session that the mother is gazing away from the

infant's face. Mother Look Number (M#) is the total number of looks during

the session produced by the mother (number of looks = number of aways ± 1).

Similar abbreviations are used for analogous infant behavior.

    One of the reasons for collecting data without experimental constraint

is that the natural upper and lower limits for the above mentioned parameters

can be obtained for each session. A disadvantage for limiting the duration

of any session experimentally is that such limitations may disrupt the

relationship that exist between these variables and their frequency of occurence.

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·RESULTS

Correlations between Total Session Time, Total Gazing Time, and Gazing Frequency

In all, 95,879 seconds of data were analyzed, including 5495 infant

gazes and 4955 mother gazes.   Each infant and mother pair contributed approx-

imately equally to the data time.   Each activity contributed substantially

to the total data, with spoon feeding providing less data time than the

other two activities.   Mothers looked at infants a greater percentage of

the total time about 70% (infants looked about 30% of TST), and for longer

durations.

Table 1 shows Pearson product-moment correlation matrices for Mother

and Infant Total Looking Time, Total Away Time, Total Number of Looks, and

Total Session Time for each of the three activities.   Scatter plots for

a representative sample of these correlations appear in Figure 1.   Each

mother and infant produced points on the plots that show the same general

tendency as the total correlation which sums other mother and infants.

Insert Figure 1 about here

While product-moment correlation is not the only statistic that could be

used to describe the data, it does not misrepresent the tendencies of each

mother and infant.

Play

Beginning with the matrices for play at the top of Table 1, for the

looking matrix, 8 of the 10 correlations listed are significatly different

from zero to the .001 level.   A two sided critical region was chosen for

these variables because prediction whether the correlations would be positive or negative is difficult a priori. For the not-looking matrix, seven of the correlations are significantly different from zero.

The highest relation between any two variables, for either condition and for all activities is the .95 correlation between MTLT and TST for play. The correlation between M# and TST is not significatly different from zero. For mother then, what is important for determining the length of the inter-action is not how often she looks, but how long.

Just the reverse is true for the infant during play. ITLT correlate .57 with TST and .56 with MTLT, but I# correlates .74 with TST and .72 with MTLT. The correlation between ITLT and M# is not significant. In other words, how much the infant looks is not as important to either the TST or the MTLT, as how often he looks. With not-looking the Infant Total Away Time (ITAT) correlates .82 with TST. This explains part of the third matrix on the top row of Table 1 which shows that ITAT correlates .79 with MTLT. The more the mother looks, the more the infant doesn't and vice versa. Also, the more the infant doesn't look, the longer the session goes and vice versa.

Part of the picture that emerges during play is of a willing mother and a reluctant infant. Longer and fewer looks are produced by mother, (Peery & Stern, 1975) and session length is determined by how long mothers look.[1] By contrast, infant looks are shorter, they stay away longer (Peery & Stern, 1975) and the more the mother looks the more the infant won't during play.

That is not the entire picture, however. There are two seemingly contradictory correlations here. ITLT correlates .56 with MTLT, but ITAT correlates .79 with MTLT. The seeming contradiction can be explained by two separate processes that are observed during the play sessions. The first

process is analogous to what Cohen (1972) has called attention getting stimuli. The infant does not seem ready to look, the mother fixes the infant's face, and goes through her entire playful, attention getting repertoire. But, the more she looks the more the infant avoids, hence the MTLT-ITAT .79 correlation. Occasionally the mother gets what she seeks and the infant looks at her. She then displays attention keeping behavior, smiling, cooing, and caressing. Now the infant seems to be enjoying this face to face contact and stays with the mother, hence the MTLT-ITLT .56 correlation. This kind of attention seeking--attention maintaining behavior is common among all the mothers observed in this study, and it is nice to see it represented by the hard data.

Bottle Feeding

For the bottle feeding matrices only 4 out of 10 correlations are significantly different from zero for looking, and 3 out of 7 for the not-looking matrix. None of the third matrix correlations reach signif-icance.

The most interesting data for bottle feeding is found in the third matrix which displays the correlations between ITLT, ITAT & MTLT, MTAT & ITLT and MTAT & MTLT. One of the constraints put on the interaction by bottle feeding is an absolute time limit. That is to say, the session is over when the bottle is empty (or the baby is asleep) regardless of what has been going on socially during the session in terms of looking. Since the infant sucks at a fairly constant rate, TST is a function of how much milk is in the bottle. The correlations between ITLT and ITAT, and MTLT and MTAT are negative. Though these correlations are not high, it makes sense that the correlation would be in the negative direction.

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If there is a limit on TST because of the amount of milk to be consumed,
the more an individual spent his time looking, the less time would be
available for not-looking and vice versa. Mother is not as likely to seek
actively the infant's gaze while he is away from her, as with play, but
will more readily accept that the infant is occupied and not available
for looking interaction, and mother will turn away also. MTAT-ITAT
correlation is .66.

Spoon Feeding

The last row in Table 1 presents the data from spoon feeding. The
primary aim of spoon feeding is to empty the bowl of food. The bowl will
be emptied with a fixed number of spoonfuls. It is not surprising to find,
then, that the M# (one per spoonful) is highly correlated with TST (.86).
MTLT is not so highly correlated with TST (.59). I# shows no correlation
with MTLT. M# is also not significatly correlated with MTLT.

Once again, the nature of the spoon feeding activity explains these
statistics. The infant gets the spoonful of food whether he is looking
at the mother or not, and regardless of how often he looks at her, she
will be back with more food as soon as the spoon is filled again. The
amount of time the mother spends looking at the baby increases during
spoon feeding depending on how many additional swipes are necessary to
get all the food inside the infant to stay, not upon whether the infant
is or is not looking. It would be expected that M# would not be a good
predictor of how long the mother will look at the infant, since that is a
function of the infant's reluctance to eat. It would be more likely for
MTAT to be positively related to M# (which it is, .75) since the total
time necessary to fill the spoon from one spoonful to the next is constant.

DISCUSSION

The data from this study present evidence that both mother and infant utilize different strategies for gaze regulation during each of the three activities, and that each is socially responsive to the different situation constraints. We need to broaden our thinking about infants' social capabilities to include the notion that they can be socially responsive when three-months-old. This view of infants is not new but it is still true that we tend to think less of young infants' capabilities than perhaps we should. Data in this study also suggest that we must be careful not to generalize from data gathered in one situation to expectations for a different situation. Data gathered on mother-infant interaction during a feeding situation (eg. Osofsky & Danziger, 1974) may not present an accurate picture of their interaction during another activity. We realize that adults' social interaction is subject to change with different circumstances, it is interesting that infants social interaction may also vary as a function of different circumstances.

By reporting correlations between gazing statistics and session duration for both adults and infants, instead of reporting measures of central tendency or total gazing time only, we have been able to explicate some of the social processes occuring between mother and infant. Free play is the activity which produces the strongest relationships among the variables. Because play, as defined in this study, is social interaction for its own sake, it is interesting that this activity produces the strongest relationships among our measures of social gazing. The picture of a willing mother and a reluctant infant during play, which has been reflected by mean and median gaze duration (see Peery & Stern, 1975) is reinforced by these

data. It is the mothers who are visually captivated by their infants.
Increased mother gazing correlates with infant avoidance, and the more
infants avoid, the more mothers look, and the longer the session continues.
Our mistrust of gazing as an infant attachment behavior expressed previously
(Peery & Stern, 1975; 1976) is further confirmed by these findings. It
is the mother who seeks contact with the infant, and therefore, who seems
most attached. These findings also indicate that during play, the frequency
of infant gaze may serve as a releaser or trigger stimulus for Mother Total
Looking Time to a greater extent that the total duration of infant looking.

When the focus of the interaction shifts from the individuals'
relationship with each other, to accomplishing a particular task (feeding),
the number of significant correlations between the gazing indices decreases
dramatically. Bottle feeding seems to be a combination of social and task
activities. Mother looking is highly correlated with total session time.
Infant looking time correlates about the same with mother looking time as
it did during play, but the correlation between infant away time and mother
looking time is not significant during bottle feeding, as it was during
play. This may be due, in part, to a decrease in motor activity which
accompanies sucking (Kessen & Leutzendorff, 1963). It may also be that
the soothing effects of sucking and feeding decrease arousal levels for
the infants, making it less likely for them to seek attenuation of the
social contact they experience during bottle feeding, as they do during
play. During bottle feeding mother looking time is more highly correlated
with infant looking time than with the number of infant looks, as it was
during play, and infant mean and median look durations are longer during
bottle feeding than during the other two activities (Peery & Stern, 1975).

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Breast and bottle feeding are quiescent times when both mother and infant

relax and enjoy a quiet moment together. Mothers typically try to calm

their infants during bottle feeding. Play activities by contrast seem

to be a time of arousal when mothers seek to stimulate their children and

to maintain positive excitement (Stern, 1974). Our correlational data

lend support to these intuitive impressions.

The goal of spoon feeding is to empty the bowl of food into the infant

as effeciently as possible. Spoon feeding is primarily a task oriented,

rather than a social activity. Many of the significant correlations during

spoon feeding are best interpreted as a function of the task. Number of

mother looks --rather than mother total looking time--is highly correlated

with total session time because there is usually one look per spoonful,

and a fixed number of spoonfuls before the bowl is empty. Infant away time

correlates highly with total session time because if the infant has turned

his head away from the mother he is more difficult to feed. Infant away is

one measure of the infants reluctance to eat, and it is not surprising that

it takes longer to feed a recalcitrant, than a willing infant.

It is especially important to be aware of the effect of imposing time

limits on the interaction. This is done inadvertently during the feedings

because of the quantity of food to be consumed. Such constraints reduce the

potency of the relationships between Total Session Time, and the other

measures of gazing.

Methodologically the technique of using correlation matrices for

Total Gazing Time, Gazing Frequency, and Total Session Time proves to be

a powerful tool for demonstrating the influence of situation variables on

social gazing interaction, and for illuminating the confounding nature of

activity constraints with and across situations. It is an interactional

measure of social activity whose application need not be limited to infants.

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FOOTNOTES

1. Correlation statistics themselves can not be interpreted causally. Because of obvious cause-effect relationships among variables, we have infered some causal interactions throughout the paper. Since Total Session Time is a dependant variable, for example, we infer that the .95 MTLT-TST correlation is best interpreted by assuming the mother is causing the TST changes, not the other way around.

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Situation effects on gazing 14

Table Titles

Table 1.   Pearson product-moment correlation matrices for the variables

listed during play, bottle feeding, and spoon feeding activities.

Play

	ITLT	MTLT	I#	M#
TST	.57	.95	.74	.23
ITLT		.56	.61	.22
MTLT			.72	.60
I#				.59

	ITAT	MTAT	I#	M#
TST	.82	.70	–	–
ITAT		.55	.69	.70
MTAT			.52	.57
I#				–

	ITLT	MTLT
ITAT	.23	.79
MTAT	.38	.63
N = 48		

Bottle Feed

	ITLT	MTLT	I#	M#
TST	.47	.74	.44	.53
ITLT		.60	.45	.36
MTLT			.40	.37
I#				-.00

	ITAT	MTAT	I#	M#
TST	.78	.61	–	–
ITAT		.66	.30	.35
MTAT			.40	.25
I#				–

	ITLT	MTLT
ITAT	-.18	.39
MTAT	-.13	-.11
N = 48		

Spoon Feed

	ITLT	MTLT	I#	M#
TST	.49	.59	.50	.86
ITLT		.42	.54	.36
MTLT			.01	.34
I#				.37

	ITAT	MTAT	I#	M#
TST	.83	.73	–	–
ITAT		.68	.29	.74
MTAT			.59	.75
I#				–

	ITLT	MTLT
ITAT	-.02	.35
MTAT	.22	.02
N = 45		

ITLT = Infant Total Looking Time   MTLT = Mother Total Looking Time
ITAT = Infant Total Away Time   MTAT = Mother Total Away Time
I#   = Number of Infant Gazes   M#   = Number of Mother Gazes
TST = Total Session Time

Note: Two sided critical region for N = 45 is -.46 to +.46   = .001

Figure Caption

Figure 1. A representative sample of the scatter plots for the

correlations presented in Table 1.

FIGURE 1   15