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The perception of eye contact*

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Ss made judgments of whether or not they were being looked in the eye as an E fixated several points on and off their faces. Distance between sender and receiver, sex, and whether the sender made a sequence of fixations prior to the terminal fixation were variables of interest. The sender-receiver distance produced less effect than predicted from the hypothesis that receiver judgments were determined solely by the discrepancy between the sender's iris/sclera configuration (ISC) during true eye contact and the current fixation point. There was no stable difference in accuracy as a function of whether the sender's terminal fixation was preceded by other fixations or not. These findings cast doubt on the belief expressed in recent studies that the ISC can be used to accurately discriminate eye gazes from other gazes. The results also suggest that fixations on some portions of the face yield a judgment of eye contact which might be predicted on the basis of social experience.

The human face is known to be a potent stimulus, even in early infancy; the eye configuration, in particular, has been found to be important for releasing social responses such as smiling and vocalization (Wolff, 1961; Bloom & Erickson, 1971). Recent work has shown that babies fixate on the eye area as early as 7 weeks of age (Bergman, Haith, & Mann, 1971). The human eyes and face continue to be powerful attractants of visual attention in normal social intercourse throughout adulthood for both the speaker and the listener. Es have used eye contact as an indicator variable in studies of nonverbal communication of power, affiliation, preference, and competition (Argyle, 1967; Exline, 1972; Mehrabian, 1969). People generally "feel" that they know when another looks them in the eye; psychologists have assumed that these feelings are correct.

The majority of studies of eye contact have depended on the reliability of third-person judgments of the behavior of one of the participants in an observed dyad. In addition, most studies have assumed that at least one person in a dyadic interaction knows when the other is maintaining eye contact. Often cited as justification for this assumption are studies by Gibson and Pick (1963) and Cline (1967), who further suggested that the mutual glance (what we call eye contact) is a unique phenomenon, easily discernible from other directions of gaze. However, recent work by von Cranach (1970) and his associates in Munich has suggested that the perception of another person's gaze may be less accurate than human visual acuity would theoretically permit, and that there is nothing perceptually unique about eye-to-eye gazing for either the person receiving the gaze or for an observer of the interaction.

Even though people are somewhat less accurate than might be expected, von Cranach agreed with Gibson and Pick in arguing that, at distances less than 2 m,[1] a receiver discriminates the sender's on-eye from off-eye gazes on the basis of cues provided by the sender's iris/sclera configuration (ISC). Thus, as the sender fixates points on the receiver's face which are increasingly distant from the receiver's eye, the sender's ISC also becomes increasingly different from that observed when he fixated the receiver's eye. Among other questions, the present study sought to investigate adults' use of ISC cues in making judgments of eye contact by determining the effect of receiver distance within the 2-m range on accuracy of eye gaze judgments.

It was felt that receivers might normally use a frame of reference based on comparisons between the perception of non-eye gazes and those made directly on the eyes to discriminate eye contact. Accordingly, an eye-movement condition (as well as a stationary fixation condition) was included in the present study. In the movement condition, the sender preceded his terminal fixation by a series of fixations on and off the receiver's face and eyes.

Differences in methodology and sketchy reporting of data make the Munich and other studies difficult to compare. However, Vine (1971), in his review of the Munich studies, suggested that one important variable differing among the studies was the degree of artificiality in the various experimental settings. Previous studies have almost uniformly employed sender fixation positions which were arbitrary; e.g., predetermined points on a grid placed in front of the receiver's face (Cline, 1967; Anstis, Mayhew, & Morley, 1969; von Cranach, 1970). The present experiment attempted to increase the natural quality of the experimental setting by having the sender fixate on several salient

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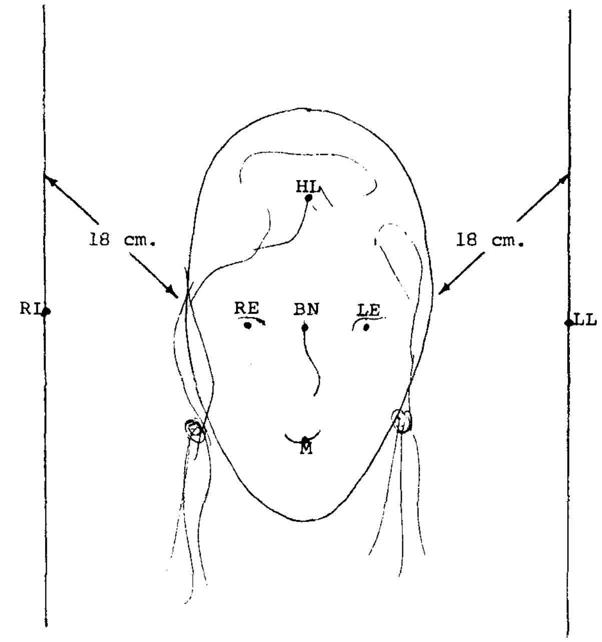

Fig. 1. Schematic presentation of the seven terminal points used in the experiment.

features of the receiver's face as well as on two "arbitrary" targets.

METHOD

Subjects

Sixteen male and 16 female college students, all of whom had normal vision or wore contact lenses, served as Ss. Four Ss participated in the study for a second time for the purpose of determining reliability of judgment. Their second set of accuracy scores, which were not included in the analysis, were all within 2% of their first scores.

Materials and Procedure

The S sat in a chair facing the E at a distance of either 103 cm (near condition) or 176 cm (far condition), separated by a table or by a table and a desk, respectively. The back of S's chair supported an upright cardboard sheet, which was placed immediately behind the S's head (about 18 cm from his fact), on which were drawn three parallel vertical lines. The central line corresponded to the position of the central vertical axis of S's head; the adjacent lines, which served as off-face fixation points, were 17 cm to the right or left of it.

The S's head was kept relatively immobile by a chinrest, which was mounted on the table. The E was female, had large blue eyes, and normal uncorrected vision. To eliminate facial gestures as cues to E's locus of fixation on S's face, E wore a cotton hospital mask which covered her mouth, cheeks, and the lower part of her nose.

Each S participated in both the near and far conditions. The sequence of presentation of these conditions was counterbalanced within sex groups. Additionally, one-half of each sex group was randomly assigned to a stationary or moving condition. In the stationary condition, each trial began with S's eyes closed. The E then fixated a particular point on or near S's face and held the position while S opened his eyes and made a yes/no judgment about whether E was looking at his eye. The movement condition was identical, except that E fixated consecutively on three points on or near S's face before the final point was fixated; the S judged only the terminal fixation.[2] Final fixations usually lasted about 5 sec in both conditions.

The E fixated five terminal locations on S's face; hairline (HL), bridge of nose (BN), mouth (M), center of left eye (LE), and center of right eye (RE), as shown schematically in Fig. 1. Additionally, two locations off the face were fixated; these were on the same horizontal axis as the eyes and on a vertical axis corresponding to the left line (LL) or the right line RL) on the cardboard sheet. These seven fixation locations were the only points used in both the movement and stationary conditions. A second E sat behind the S and indicated to E the fixation position(s) for each trial by means of a cardboard display. E 2 also checked E 1 for any head movements or tilting.

Each S participated in 12 practice trials, followed by 50 experimental trials at each distance. The sequence of terminal positions for the experimental trials was random, with the constraint that 12 fixations occurred on one eye, 13 on the other, and 5 each on the remaining five points within each block of trials. Additionally, approximately one-half the fixations on each point appeared in the first 25 trials in a block of trials. For the movement condition, the three preterminal points on each trial were randomly determined, with the exception that an eye was fixated at least once but no more than twice on every trial. Ss were not informed that points on or off their faces were being fixated or that 50% of the fixations were on eyes and 50% off.

RESULTS

Table 1 shows the average absolute distance in centimeters (except for LL and RL) from each terminal fixation point to the nearest eye for Ss in the near and far conditions. The visual angle between these points, from the sender's position, is also shown. From the sender's perspective, all points were on approximately the same frontoparallel plane, except for the LL and RL points.

Table 1 also shows the average percent of "yes" responses (S judges E to be looking at his eyes) for each terminal point. A 2 by 2 by 2 by 5 analysis of variance of the error scores, excluding the LL and LR positions, included sex of "receiver" (S), fixed vs movement condition (C), and order of presentation of distance (O) as between-S variables, and distance (D) and position (P) as within-S variables. Significant position [P factor, $F(4,96) = 24.54$, $p < .01$] and distance [D factor, $F(1,24) = 12.32$, $p < .01$] effects were found. The average percent of "yes" responses (collapsing across near/far conditions) were as follows: RE, 67.2%; LE, 62.4%; BN, 69.3%; M, 48.8%; HL, 17.9%; RL, 5.0%; LL, 6.0%. Even if one uses conservative judgment and considers BN to be an "eye" position, the error rates ranged from 31% to 38% for fixations on the eyes and 5% and 49% for fixations off the eyes, thus lying well beyond common expectation (Gibson & Pick, 1963; Cline, 1967). The large difference in error rates between the mouth (49%) and the hairline (18%) positions was of particular interest, because these two points were approximately the same distance from the nearest eye and should have produced equivalent changes (from eye-eye fixation) in the sender's iris/sclera configuration as they were fixated.

The D effect was in the expected direction, with a

38.5% error rate at the near distance and a 44.0% rate at the far distance. However, as indicated by a stable D by P interaction [$F(4,96) = 4.86$, $p < .05$] and specific comparisons, the only substantial effect of distance on judgment was at the HL position, where mean error was only 6.4% in the near condition and 29.4% in the far condition [$t(4) = 5.02$, $p < .01$]. Thus, distance did not have the consistently strong effect on accuracy that judgments based on iris/sclera configuration cues (which should change directly as a function of increasing visual angle between sender's fixation points) alone would be expected to produce.

No main effects of S or C emerged, but there was a S by C interaction [$F(1,24) = 4.96$, $p < .05$], reflecting more correct judgments in the movement than in the fixed condition for males (39.8% vs 45% mean error rate) but a reversal of this relationship for females [42.3% vs 38.1%; $t(24) = 2.33$, $p < .05$].

Finally, a stable S by C by D interaction was found [$F(1,24) = 4.35$, $p < .05$]. With one exception, males and females performed better at the near than at the far distance, whether they were in the stationary or moving condition; the interaction was produced by the absence of any distance effect for females in the moving condition.

It is also of interest that there was a great range of individual differences in the ability to accurately discriminate fixation positions on and off the eyes. Scores for individuals ranged from 9.4% to 62.0% errors.[3]

Table 1
Average Distance and Visual Angle of the Seven Terminal Fixation Points from the Closest Eye and the Percent of Positive Judgments Made by the Subject at Each Point

Terminal Point	Average Distance (cm)*	Visual Angle (Deg)		Percent of "Yes" Responses	
		Near	Far	Near	Far
Hairline (HL)	8.8	4.7	2.6	6.4	29.4
Left Eye (LE)				62.5	62.2
Bridge of Nose (BN)	3.6	2.0	1.1	70.0	68.7
Right Eye (RE)				67.5	67.0
Mouth (M)	7.6	4.2	2.4	46.3	51.3
Left Line (LL)	**	6.3	4.0	2.8	9.2
Right Line (RL)	**	6.3	4.0	4.0	6.0

**For the HL, M, and BN positions, respectively, the difference in average values for males minus those of females was +1.0, +.5, and +.5.*

***Values were 13.6 if eyes and lines were considered to lie on the same fronto-parallel plane; however, the lines were behind the head, thus reducing their visual angle for the S.*

DISCUSSION

Both Gibson and Pick (1963) and von Cranach (1970) argued that judgments by one person (receiver) of whether a second person (sender) was looking at his face or his eyes could accurately be made on the basis of the sender's ISC cues. As the sender fixates points on the receiver's face which produce increasing visual angles to the closest eye, the sender's ISC becomes increasingly discrepant from thatproduced by an eye fixation. The present findings indicate that, though people probably may be able to judge eye contact by using ISC cues, very few Ss in this experiment consistently did so. If such cues were the sole determinants of our S's judgments, we would expect that the change in the sender-receiver distance from 103 to 176 cm, which decreased the sender's visual angle by almost 75% for each fixation position, would have had a substantial effect on receiver accuracy at each point. This was true only at the hairline and at the left line position. Moreover, though Ss were relatively accurate in discriminating hairline fixations from eye fixations, they were highly inaccurate in judgments for mouth fixations, even though the extent of the ISC cues for these two positions should have been virtually identical.

The present findings can be compared to those of Cline (1967), who indicated that Ss in his experiment probably used ISC cues in judging non-BN gazes, but that their high degree of accuracy at BN could not be accounted for solely on the basis of these cues. Cline therefore concluded that there was something unique about gazes directed at BN (and presumably the eyes), which caused these fixations to be more often (and accurately) perceived as eye contact than other gazes. Data from the present experiment contradicted this conclusion, however, since not only did Ss in the current study inconsistently judge gazes directed at the eyes to be eye contact, but they often inaccurately perceived fixations upon the mouth to be eye gazes as well.

The poor performance at the mouth position relative to the hairline position may reflect more difficult judgment in discriminating a downward glance from center than an upward glance, where movement of the eyelids and eyebrows might supply added cues. However, it is also possible that listeners in a social interaction look at the mouth area more frequently than is realized, causing the speaker to assume that he is being looked in the eye when, in fact, the listener is looking at his mouth.

The unexpectedly low levels of accuracy obtained in this study may indicate that adults normally rely on cues not available in this experiment (such as facial expressions). An additional cue might be a "frame of reference" which could be established when the receiver views the sender's eyes as the sender alternately scans off-eye and on-eye positions on the receiver's face. Our hypothesis that this cue was a critical one was not borne out by the data; no differences were found between the stationary fixation and eye-movement conditions. However, the possibility exists that "frame of reference" cues may depend on the simultaneous availability of other cues, such as facial gestures. On the other hand, both von Cranach (1970) and Vine (1971) have proposed that in normal social encounters people either look one another in the eye or look well away from the face of the other person, thus suggesting that discrimination between fixations on different parts of the face are rarely necessary. It could even be that a "feeling of eye contact" depends on the persistence of the sender's gaze in remaining on the receiver's eyes and following them as the receiver makes small facial and body movements. We must also admit the possibility that people *react* differentially to "true" eye contact, even though their judgments of its occurrence are relatively inaccurate.

Thus, we must conclude that though it may be possible to differentiate eye contact from face-to-face looking on the sole basis of ISC cues, this fine perceptual distinction is probably rarely made, at least not without the use of other facial or social cues. Since it is extremely unlikely that ISC could suffice for accurate judgment by a third person of when a sender is looking at a receiver's eyes, perhaps these other cues are used to increase accuracy. At a minimum, the present study indicates that confirmatory data on this matter should be sought. Whether the present findings pose merely a semantic problem—requiring that Es use the term "face-to-face looking" rather than "eye contact"—or a deeper issue is a matter for future empirical work to determine. A better specification of the cues people use to make judgments of eye contact, however, would seem valuable from a perceptual, a social, and a methodological point of view. We hope the present study is only a first step in this direction.

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NOTES

1. This description applies only when the sender and receiver face one another directly.

2. The first position was fixated about 3 sec to give S a chance to focus on E's eyes; each successive preterminal fixation was held for about 1 sec.

3. These error scores were computed without including BN, since it was questionable whether BN should be interpreted as an on-eye or off-eye gaze.

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