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Visual Dominance and Visual Egalitarianism: Individual and Group-Level Influences of Sex and Status in Group Interactions

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Abstract This study investigated visual dominance and visual egalitarianism of men and women ($N = 94$; 17 teams) in team meetings at diverse workplaces. Two novel gaze-related measures were developed: (a) a *group visual dominance ratio* (group-VDR) assessing each member's visual dominance vis-à-vis all other members, and (b) a *gaze distribution index* (GDI) assessing each member's visual egalitarianism to all group members. Multilevel analyses were conducted to account for influences of the team members' sex and status on the individual level and for influences of sex and status composition of the teams, and the team leaders' sex on the group level. Results suggested that high-status individuals displayed more visual dominance than low-status individuals. The significant interaction of individuals' sex and status indicated that the positive relationship of status and visual dominance applied particularly to women. The more women in a team, the more visual dominance was displayed. The team leader's sex significantly influenced visual egalitarianism: Gaze distribution was less egalitarian when the team leader was male.

Keywords Gaze · Gender · Dominance · Egalitarianism · Group interaction

Introduction

Gaze can transmit essential social information such as influence relations (Dovidio and Ellyson 1985) or turn-taking rules (Kalma 1992). This study investigated social dominance

The article is dedicated to Joseph E. McGrath who died in April 2007, and to his wife Marion McGrath who followed him in June 2008.

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and egalitarianism displayed by persons in work group interaction, as assessed by gaze behavior. The research focused on the influence of gender and status in this context. Previous studies of face-to-face interaction in groups found differences in verbal and nonverbal communication of dominance between high- and low-status group members (Ridgeway et al. 1985; Ridgeway and Bourg 2004; Ridgeway and Diekema 1992). Although a recent meta-analysis did not find status effects on overall gaze behavior (Hall et al. 2005), status differences have been shown to affect the display of visual dominance as measured by the visual dominance ratio (Dovidio and Ellyson 1985; Dovidio et al. 1988b; Exline et al. 1975). Gender differences in the visual dominance ratio (VDR) have also been found (Dovidio et al. 1988a, b; see below). However, the VDR research has been conducted mainly on face-to-face interactions of dyads—not in the context of groups. The analysis of men's and women's gaze behavior in high- and low-status positions in group contexts can contribute to our understanding of how influence and egalitarianism are communicated nonverbally (Copeland et al. 1995; Hall 1984; Schmid Mast 2002).

Gender, Status, and Visual Dominance

The visual dominance ratio is assumed to reflect a person's influence/dominance in a dyad (Dovidio and Ellyson 1985; Exline et al. 1975). It is defined as the ratio of two percentages, with each percentage consisting of the amount of time a person is looking at another person divided by the first person's talking time. The numerator is the percentage a person is looking to the other while speaking herself or himself, and the denominator is the percentage the person looks at the other while listening to the other—that is, the proportion of looking while talking to looking while listening. In laboratory settings, the VDR is typically higher for high status compared to low status persons and higher for men compared to women if status or expertise information is not provided (Dovidio et al. 1988a, b). Although the derivation of the VDR seems to be reliable and valid in laboratory settings, there is a lack of research on the role of the VDR in real life. Therefore, it is vital to apply the findings from the laboratory studies to diverse field settings and natural groups.

The higher the VDR of person A in relation to person B, the greater is the influence of person A over person B (Dovidio and Ellyson 1985). Persons with relatively little power or status look longer at others while listening than while talking themselves, whereas more powerful persons look approximately for the same amount of time while listening and talking. Overall, less powerful persons look longer at more powerful persons, especially when in the role of the listener (Dovidio et al. 1988b; Exline et al. 1975). Visual dominance behavior primarily occurs at the nonconscious level as findings by Ellyson et al. (1981) and Exline and Fehr (1982) suggest. Nevertheless, all of these authors assume that people are sensitive to changes in visual dominance behavior and that they react accordingly. Observational studies providing nonverbal information only have demonstrated that observers are sensitive to changes in visual dominance ratios. For example, in a study by Dovidio and Ellyson (1982), observers' judgments of individuals' influence and competence were positively correlated with those individuals' VDR. Observers judged persons who looked more at others while talking than listening as more powerful than persons who displayed the opposite pattern. Thus, observers apparently used information from gaze patterns when decoding dominance or influence. Consistent with such findings, DePaulo and Friedman's (1998) review concluded that high social power is indicated reliably by patterns of looking while listening and looking while talking. These widely replicated findings provided the point of departure for the group-level visual dominance measure in this study. To date, virtually no research in groups larger than dyads has been conducted on this topic.

The present study analyzed the phenomenon of visual dominance in a natural group setting—specifically, in team meetings of diverse organizations with variable group sizes. In a natural setting of work team discussions, people normally know each other for a considerable time and hierarchies have already been established. Thus, we assumed that in such a setting high-status persons would display more visual dominance behavior than low-status persons (see Dovidio et al. 1988a, b). Moreover, previous research has shown that gaze behavior can contribute to the establishment of influence relations between men and women. Thus, Dovidio et al. (1988a) asked mixed-sex dyads to discuss a traditionally feminine task (knitting), a traditionally masculine task (oil change), or a gender-neutral task (gardening). They found that men displayed a higher VDR than women while discussing the masculine task and that women displayed a higher VDR than men while discussing the feminine task. Men also displayed a higher VDR than women while discussing the neutral task. Comparable results were obtained by Dovidio et al. (1988b). In a natural work team setting, we expected men to display more visual dominance than women, since such a prediction is consistent with the findings of Dovidio and his colleagues, as well as the findings of Conway et al. (1996) and Giannopoulos et al. (2005). Finally, our expectation is predicted by social role theory (Eagly 1987; see also Eagly and Karau 2002), which considers the effects of gender[1] on social interaction.

Visual Egalitarianism

The second aspect of our analysis was based on the premise that gaze behavior not only indicates inequality in interaction but on a different level can also indicate equality. The idea was that egalitarianism can be operationalized by assessing the distribution of an individual's gaze across the other group members, with a more balanced gaze distribution across members indicating more egalitarianism. This balanced gaze distribution signals attention to all other team members, independent of their status and their behavior. An imbalanced gaze distribution signals attention directed to only a few team members and inattention to other group members. To assess visual egalitarianism, we computed the gaze distribution index (GDI), an index operationalized as the relative duration that each person in the team looked at each of the other team members and the balance versus polarization of this gaze distribution.

Based on two sources, we expected women to display a more balanced gaze distribution than men. Bakan (1966) assumes a more communal orientation in women, which is supported by research of Eagly and colleagues who report that women show more egalitarian behavior (see Eagly and Karau 2002, for an overview). To be attentive and receptive to everybody present in the group would facilitate communication, understanding, and positive relations, all central communal behaviors. We further used theoretical assumptions underlying the Kestenberg Movement Profile (KMP), an instrument used principally for clinical and developmental movement analysis (Kestenberg Amighi et al. 1999; Kestenberg and Sossin 1979) to develop our hypothesis for gaze behavior related to

[1] According to Social Role Theory (Eagly 1987) and Role Congruity Theory (Eagly and Karau 2002) women are expected to display higher competence and dominance in feminine tasks, men are expected to display higher competence and dominance in masculine and neutral tasks, particularly in the absence of other diagnostic cues. It is assumed that this expectancy derives from observing men more frequently in higher-status positions than women (Eagly 1987; Eagly and Karau 2002). The findings of Conway et al. (1996) show that low-status persons relative to high-status persons are perceived as more communal and less agentic, and Giannopoulos et al.'s (2005) findings suggest that status may be gendered beyond the relation observed in prior research.

egalitarianism. KMP theory includes assumptions about how movement relates to meaning and yields predictions about gender differences in movement patterns. In particular, the theory suggests that indirect movement qualities (*receiving, containing, taking things in*), imply an *indirect* focus, or multi-focus in groups; and direct movement qualities (*actively approaching, selecting, aggressing)*, imply a *direct* focus, and an exclusion of other context variables in groups. Both types of movement qualities serve communication, the former in a more group-related and the latter in a more dyadic manner, and can be related to traditionally masculine and feminine gender role patterns. KMP theory generally stresses that these masculine and feminine qualities are shared by men and women, even though socialization reinforces gender stereotypical patterns. Based on KMP theory, we derived the prediction that women in groups would, on average, behave in a more *indirect*, *multi-focused* way by attempting to include the entire group in their gaze. Men, in contrast, would on average, be expected to act in a more *direct*, *dyadic* way by addressing and attending to single persons in the team at a time, not including everybody in their gaze. Hence, for men, we expected a more polarized or dyadic and less egalitarian gaze distribution in groups; whereas for women, we expected a less polarized and more egalitarian gaze distribution. We were further interested in the effects of status on gaze distribution.

In sum, we expected that (a) high-status persons would show a higher group-VDR than low-status persons, (b) men would show a higher group-VDR than women, and (c) women would distribute their gaze in a more balanced manner across all team members than men. We expected all of these effects to be smaller in our natural groups than in laboratory groups drawing on the continuum model of Fiske and Neuberg (Fiske et al. 1999; Fiske and Neuberg 1990). The continuum model predicts a decreasing influence of gender and status as the degree of acquaintance among team members increases. To address these hypotheses, we developed and applied (a) a visual dominance measure, the group-VDR, by extending the visual dominance ratio (Dovidio and Ellyson 1985; Exline et al. 1975), and (b) a measure of visual egalitarianism, the gaze distribution index (GDI). With the group-VDR, the relative status of a distinct person in the context of the whole group as interaction partner is described. To validate these novel nonverbal measures, we conducted correlational analyses comparing group-VDR to other global and specific dominance measures, and GDI to other global and specific measures related to egalitarianism. In general, we expected positive relations of the novel measures to global measures of dominance and egalitarianism respectively derived from judgments by team members and external observers. To meet the requirements of the data structure (individuals nested in groups), we conducted multilevel analysis (MLA) for inferential hypothesis testing.

Method

Sample

Seventeen teams of diverse organizations, predominantly from industrial, public administration, and training sectors participated in this study. Team members were 49 men and 45 women (mean age 38, range 20–59, $SD = 8.2$; all white). They participated voluntarily and written informed consent was obtained from each participant. Videotapes of regular team meetings were recorded. As an incentive for participation, team feedback was provided about various aspects of the teamwork (using the data of the SYMLOG short scale, see below).

Participants stemmed from ten mixed-sex and seven same-sex teams: Of the mixed-sex teams, six had a male leader and four a female leader; of the same-sex teams, three had a male leader and four a female leader. All in all, there were 24 high-status men, 22 high-status women, 25 low-status men, and 23 low-status women. Criteria for the categorization as "high-status" were (a) legitimate status (designated as team leader), or (b) a combination of academic degree (university graduation) and length of organizational membership (more than 5 years); if both criteria applied, the person was categorized as "high status" (Thimm 1990). Teams consisted of three to ten members, with a mean of 5.7. The number of years the participant had worked in the particular team ranged from 0.5 to 32.0 years, with a mean of 10.3 years. More than 95% of the team members had known one another for years. The remaining <5% were trainees or came to the team just recently. The content of the meetings was planning, organization, and information exchange.

Observational Methods

The team meetings were videotaped and digitalized. Selected scenes with a mean duration of 14.46 min ($SD = 4.61$, range 9–20 min) yielded the data. The scenes were taken from larger segments of team meetings with a range of 30 min to 5 h. Criteria for selection of scenes were good general visibility and audibility, and the involvement of as many team members as possible. We selected one or more complete topic units. Coding was done with the pattern analysis software THEME (Magnusson 1997, 2000) which uses real-time coding for analysis of interaction patterns (Koch and Zumbach 2002). The coders were told who the team leader was and labeled participants from A to Z clockwise starting from the team leader's position. They were given this information, since in a "thin slices" pretest (Ambady and Rosenthal 1992) we found that naïve observers in all cases were able to identify the leaders of the teams from segments as short as 20 s. The main rater was not blind to the VDR-literature, but was unaware of the exact hypotheses. Since the information load in coding gaze behavior is extremely high, we anticipated negligible expectancy effects. Every time a person changed the gaze direction or started or stopped talking a specific marker was set. The timeline in THEME is given in frames, with 25 frames corresponding to 1-s. In all formulas, time is operationalized by frames. Two hours and 41 min (241,191 frames) of coded team meetings (22,290 codes) served as the basis for the calculations. The fact that not all participants acted for the same amount of time and that not all scenes were of the same duration was addressed by basing all calculations on the percent values of each observational variable. The group-VDR and the GDI accounted for this issue via the formulas used (see Table 1 and "Appendix B").

Observer agreement was calculated for two student raters, a man and a woman (the main rater), who had independently coded the gaze behavior of four out of the 94 participants from two different teams. In addition, one participant was coded from two different camera perspectives by the main coder of the study. This check of "perspective-reliability" provided additional information about (a) the consistency of the main coder and (b) the quality of the videotapes in relation to the observational goals. For both inter-rater and perspective reliability, Cohen's Kappa for nominal data was computed (Cohen 1960). Kappas between coders ranged from .62 to .76 ($M = .69$) and percent agreement from 76.5 to 90.4% ($M = 81.7\%$); this demonstrates substantial agreement according to Landis and Koch (1977). The kappa of .59 or 74% between perspectives was also tolerable.

Visual Dominance Measure

To develop a visual dominance measure for groups, we started from the *visual dominance ratio for dyads*. Following Dovidio and Ellyson (1985) and Dovidio et al. (1988b), the

Table 1 Visual dominance measure for groups: group-VDR compared to VDR for dyads

Term description	Term
Formula 1: Visual dominance ratio for dyads (VDR; Exline et al. 1975; Dovidio and Ellyson 1985)	$\dfrac{\frac{\text{A lwt B}}{\text{A talk total}} \times 100}{\frac{\text{A lwl B}}{\text{A listen total}} \times 100}$
Formula 2: Group visual dominance ratio (*Group-VDR*)	$\dfrac{\frac{\text{A lwt total} - \text{A lwt away}}{\text{A talk total}} \times 100}{\frac{\text{A lwl total} - \text{A lwl away}}{\text{talk total group without A}} \times 100}$

lwt looks while talks, *lwl* looks while listens, *away* looks away, i.e., neither at the entire group nor at a certain target person; see "Appendix A" for an application example, and for adjustments of *Formula 2* under specific conditions

VDR for person A interacting in a dyad with person B is computed as shown in Table 1, Formula 1. According to Dovidio et al., the numerator is the ratio of A looking at B as a proportion of the total speaking time of A. The denominator is the ratio of A looking at B in relation to the total speaking time of B. If A looks at B for the same proportion in both speaking modes, the VDR has a value of 1. If A looks at B longer while A himself is talking than listening, the numerator becomes larger than the denominator, and the VDR is greater than 1. In the reverse case, if A looks at B longer when B talks than when A talks, the denominator becomes larger than the numerator, and the VDR is less than 1 (see Table 1, Formula 1).

In the present study, we developed a formula for a *group visual dominance ratio* (*group-VDR*) that reflects the visual attention that a person A pays to all team members dependent on A's and the group's speaking mode (i.e., *A talks* or *A listens while team members are talking*). This formula appears in Table 1 (Formula 2) as an example for group member A. The numerator consists of the proportion of the entire speaking time of A that A looks at any group member. The denominator consists of the amount of the other group members' total speaking time that A looks at any one team member but does not talk. The formula was applied to each participant. The calculation for a group of three persons appears in "Appendix A". We further developed two adjustments for times, when the person whose group VDR was calculated was not visible (out of sight) and for times when a person was absent. We did this under the assumption that the behavior of the group during the absence of a person is proportional to the behavior during the entire observation time (see "Appendix A"). The coding procedure made these adjustments necessary.

Other Dominance Measures

Self-ratings of dominance and team-ratings of each participant's dominance (as the mean of all other team members' ratings of the participant), were acquired using the short form of the SYMLOG adjective ratings. SYMLOG is the system for multi-layer analysis of groups developed by Bales and colleagues (Bales and Cohen 1982). For SYMLOG adjective ratings, two adjective dimensions ("*active, dominant, talks a lot*" versus "passive, *introverted, talks little*") were provided and rated on a bipolar scale from −18 to +18 (Bales and Cohen 1982). Three global dominance measures were assessed: Every participant gave a self rating and gave and received, respectively, a rating of all other participants of his/her team. In addition, external raters judged participants' overall dominance and nonverbal dominance in terms of expansiveness, i.e., the space somebody takes, on rating scales from 1 (*very little*) to 4 (*very much*) (Mehrabian 1970). Further, two specific measures for dominance talking times and frequency of interruptions were assessed by two external raters by manual stopping (Schmid Mast 2002; Thimm et al. 1994). Inter-rater reliabilities of main raters for the frequency counts and the talking times were all $r > .90$ (intraclass correlation; Ebel 1951) and $r > .60$ for the global and the nonverbal dominance ratings. Raters were two female students for nonverbal dominance, two different female students for interruptions, and a student team of five women and two men for talking times. For the global dominance ratings, there were two female and two male student raters.

Visual Egalitarianism Measure

Visual egalitarianism was assessed by the extent to which a person's gaze was evenly distributed among team members. We operationalized gaze distribution by means of a gaze distribution index (GDI) with values between 0 and 1 (see Table 2, Formula 3), where 0 was defined as an extremely polarized gaze distribution and 1 as an exactly balanced gaze distribution. To calculate standardized GDI-values, we made the following assumptions: (a) an exactly balanced gaze distribution resulted if a person looks at each other member of the group for exactly the same amount of time, and (b) the most polarized (unbalanced) GDI-value is reached if a person looks only at a single person during the entire time. The mathematical derivation and standardization procedure are provided in "Appendix B".

Other Measures Related to Egalitarianism

Participants judged whether the team is a democratic team (i.e., 'We are a democratic team in which nobody is overly influential'), with a flat hierarchy (i.e., 'We are a team in which competence and good ideas are valued and integrated across different status positions and hierarchy levels'), and a positive atmosphere (i.e., 'We are a team with a positive atmosphere'); the potential for self-actualization the team offers to them (i.e., 'Within this team I clearly perceive the potential for self-actualization') and the work satisfaction they experience (i.e., 'I am truly content in this team') on single items on scales from 1 (*applies not at all*) to 5 (*applies exactly*). Furthermore, participants judged their perceived authenticity within the team (4 items; from 1 = *applies not at all*, to 5 = *applies exactly*; e.g. 'At my workplace I can just be the person I am/my true self') and their perceived gender fairness in their organization (adapted from Powell 1999; 8 items, also from 1 *applies not at all* to 5 *applies exactly*; e.g., 'The management takes equal treatment of men and women seriously'; or 'This is a good workplace for women'; or 'Important tasks are distributed independent of the gender of the person').

Table 2 Measure of visual egalitarianism for groups: gaze distribution index GDI

Term description	Term
Formula 3: Gaze distribution index GDI_p	$1 - \frac{n-1}{2\times(n-2)} \times \sum_{i=1}^{n-1} \left\| \frac{1}{n-1} - t_i \right\|$

n is the number of persons within a group (group size); t_i is the standardized time a person p looks at another person p_i. GDI_p is a standardized value between 0 (polarized) and 1 (balanced); see "Appendix B" for derivation

Multilevel Modeling

In order to analyze the influences on group-VDR and GDI, the nested, hierarchical data structure needed to be taken into account. Because participants were clustered within teams and persons within a team may have been more alike than persons in different teams, the assumption of independent residuals could have been violated. Ignoring the non-independence by only considering level-1 data can lead to increased Type I errors (Tabachnick and Fidell 2007). To account for the influences on different levels, we computed multilevel analyses in M*plus* (Muthén and Muthén 1998–2007). Intraclass correlations were $\rho = .14$ for group-VDR and $\rho = .32$ for GDI indicating that about 14 and 32%, respectively of the variability in the dependent variables were accounted for by differences between teams. Thus, group-level clearly mattered. The inclusion of variables on both the individual and the group-level allowed us to analyze effects of within-level variables controlling for the effects of team membership. Calculations consisted of two multilevel analyses with group-VDR and GDI as the dependent variables, respectively. Independent variables were sex (male vs. female), status (high vs. low) and their interaction on level 1; team sex composition, team status composition, and the team leader's sex were incorporated on level 2. Sex and status were coded using dummy variables; sex: female (0) vs. male (1); status: low (0) vs. high (1). The aggregated variables team sex composition and team status composition were represented by relative frequencies.

For both dependent variables, the hypothesized underlying models were the same. We computed random intercept models by specifying the intercepts as varying across level 2 units, but no random slopes for the level 1 predictors (see equations below). Random slope effects were not of interest, because we had no specific hypotheses for these effects. Instead, level 2 predictors were expected to have main effects on the dependent variables. The detailed prediction equations (on level 1, level 2, and combined) for the dependent variables are as follows:

$$Y_{ij} = \beta_{0j} + \beta_{1j}(\text{Sex})_{ij} + \beta_{2j}(\text{Status})_{ij} + \beta_{3j}(\text{Sex} \times \text{Status})_{ij} + e_{ij} \qquad \text{(Level-1 Model)}$$

$$\begin{aligned}\beta_{0j} = {} & \gamma_{00} + \gamma_{01}(\text{Team sex composition})_j + \gamma_{02}(\text{Team status composition})_j \\ & + \gamma_{03}(\text{Team leaders sex})_j + u_{0j} \qquad \text{(Level-2 Model)}\end{aligned}$$

Leading to the combined equation:

$$\begin{aligned}Y_{ij} = {} & \gamma_{00} + \gamma_{10}(\text{Sex})_{ij} + \gamma_{20}(\text{Status})_{ij} + \gamma_{30}(\text{Sex} \times \text{Status})_{ij} \\ & + \gamma_{01}(\text{Team sex composition})_j + \gamma_{02}(\text{Team status composition})_j \\ & + \gamma_{03}(\text{Team leaders sex})_j + u_{0j} + e_{ij} \qquad \text{(Overall-Model)}\end{aligned}$$

Results

Preliminary and Descriptive Results

Means and standard deviations of group-VDR and GDI by sex, status, and sex of team leader are provided in Table 3. Group-VDR and GDI were not correlated ($r = -.09$, $p = .38$, two tailed; $r = .02$, $p = .90$ for women, and $r = -.23$, $p = .11$ for men). To

Table 3 Means and standard deviations of dependent measures by groups

Independent variable	n	Group-VDR (dominance measure)		GDI (measure of egalitarianism)	
		M	*SD*	*M*	*SD*
Men	49	1.37	0.79	0.48	0.11
Women	45	1.36	0.86	0.56	0.13
High status	46	1.56	0.82	0.54	0.13
Low status	48	1.18	0.78	0.50	0.12
Participants with male leader	53	1.30	0.87	0.48	0.12
Participants with female leader	41	1.44	0.75	0.56	0.12

The actual group-VDR ranged from 0 (low) to 4.7 (high). The actual gaze distribution index (GDI) ranged from 0.20 (unbalanced) to 0.74 (balanced)

assess the validity of the nonverbal measures developed, GDI and VDR values were correlated with the other dominance measures and measures of egalitarianism (all tests two-tailed). The alpha-level of all statistical tests was .05.

Validity of Dominance Measure

Correlations of the group-VDR with all three global dominance measures were positive. The higher the team members' group-VDR, the higher their SYMLOG dominance self ratings, $r(66) = .27$; $p < .05$, and team ratings, $r(68) = .32$; $p < .01$. These self- and team-ratings were also significantly correlated with one another, $r(66) = .78$; $p < .001$. The group-VDR was further related to external raters' global dominance judgments, $r(94) = .24$; $p < .05$. However, with the exception of expansiveness $r(94) = .28$; $p < .01$, group-VDR was not significantly correlated with the specific behavioral dominance indicators (talking times and interruptions).

Validity of Measure of Egalitarianism

The GDI correlated significantly with participants' judgment of whether the team was democratic $r(94) = .21$; $p < .05$, with a flat hierarchy $r(94) = .22$; $p < .05$, and a positive atmosphere $r(94) = .24$; $p < .05$; the potential for self-actualization offered $r(94) = .29$; $p < .01$, and the work satisfaction experienced $r(94) = .20$; $p < .05$. It was further correlated with team members' experienced authenticity in the team $r(94) = .23$; $p < .05$, and the experienced gender fairness in the organization $r(94) = .21$; $p < .05$.

Multilevel Analyses for Visual Dominance (Group-VDR) and Visual Egalitarianism (GDI)

MLA for Visual Dominance

Table 4 (left side) shows the results of the multilevel analysis for group-VDR. Confirming our hypothesis, there was a main effect for status on level 1, demonstrating that being of high status was related to higher group-VDR. Simple slope analyses of the significant

Table 4 Two level models of group visual dominance ratio (Group-VDR) and gaze distribution index (GDI)

Effect	Parameter	Group-VDR			GDI		
		Coefficient[a]	SE	*z* score	Coefficient[a]	SE	*z* score
Level 1							
Sex[b]	γ_{10}	.38 (.59)	.20	1.84	−.21 (−.04)	.20	−1.05
Status[c]	γ_{20}	.49 (.78)	.12	3.99***	.13 (.03)	.19	.68
Sex × Status	γ_{30}	−.36 (−.66)	.17	−2.14*	.11 (.03)	.20	.66
Residual variance	e_{ij}	.85 (.05)	.06	13.73***	.93 (.01)	.05	19.08***
Level 2							
Team sex composition	γ_{01}	−.87 (−.75)	.44	−1.98*	−.03 (−.01)	.41	−0.07
Team status composition	γ_{02}	−.23 (−.44)	.33	−.70	.36 (.15)	.34	1.05
Team leader's sex[b]	γ_{03}	.38 (.24)	.61	.64	−.72 (−.10)	.28	−2.58**
Residual variance	u_{0j}	.52 (.05)	.42	1.23	.58 (.00)	.26	2.29*

Level 1 $n = 94$; Level 2 $n = 17$, * $p < .05$, ** $p < .01$, *** $p < .001$, [a]Standardized coefficients; unstandardized coefficients in parentheses, [b]0 = female, 1 = male, [c]0 = low status, 1 = high status

Sex × Status interaction on group-VDR indicated that the regression of visual dominance on status was significant for women ($\beta = .43$, $p < .001$), but not for men ($\beta = .04$, $p = .813$). Thus, being of high status was related to more visual dominance particularly for women: low-status men $M = 1.34$, $SD = 0.91$; high-status men $M = 1.40$, $SD = 0.66$; low-status women $M = 1.00$, $SD = 0.58$; and high-status women $M = 1.73$, $SD = 0.95$. On level 2, team sex composition had a significant effect: The more women were in a team, the more visual dominance was displayed. Level-1 variables accounted for 15% of the within-level variance; level-2 variables explained 48% of the between-level variance in group-VDR.

MLA for Visual Egalitarianism

Table 4 (right side) shows the results of the multilevel analysis for GDI. On level 1, no significant effects were observed. On level 2, there was a significant effect for the team leader's sex: If the leader was a man, there was a less egalitarian gaze distribution in the team. Level-1 variables accounted for 7% of the within-level variance; level-2 variables explained 42% of the between-level variance in GDI.

Discussion

The aims of this research were to investigate gender- and status-related differences in gaze behavior in authentic organizational teams at the workplace. Although there is evidence that the VDR is a reliable and apparently valid measure in laboratory settings, there is a need to transfer findings to real-life groups and to extend the method accordingly. We thus assessed visual dominance and visual egalitarianism under non-laboratory conditions in team meetings of participants who had worked together for a long time. Building on Dovidio et al.'s (1988a, b) work, we adapted the visual dominance ratio (VDR), extending it to the group-level. The resulting group-VDR was conceptualized as a measure of social dominance and influence for participants in groups. Findings from this study partially confirmed the laboratory findings of the Dovidio-group and extended them to real life-settings: High status persons showed a higher group-VDR than low status persons in the organizational data collected. Yet, men did not show higher visual dominance than women; instead we found that high-status women showed higher visual dominance than women in low status positions and a *team sex composition* effect on level 2: the more women in the team, the higher was the group-VDR. Regarding egalitarianism, we developed a measure differentiating a balanced, more egalitarian gaze distribution from a polarized, more dyadic gaze distribution in team interaction (GDI). The new measure yielded a novel sex effect on the group-level: Persons in teams with a female leader showed a more balanced gaze distribution. The study extends prior findings from ad hoc experimental groups (mostly dyads) with assigned tasks to observations in natural work groups with real tasks and thus provides more external validity for the constructs under investigation.

Visual Dominance Behavior: The Gaze Ratio of Influence in Teams

Significant correlations of group-VDR and other dominance measures indicated that group-VDR can be assumed to be a valid measure for dominance. Group-VDR was positively correlated with three global measures of dominance: the SYMLOG self and team-rated dominance measures and the dominance ratings of external raters. Group-VDR was further correlated with nonverbal expansiveness as a specific measure of dominance. However, group-VDR was not significantly correlated with other specific behavioral indicators of dominance, such as talking times, or interruptions (verbal dominance). These findings indicate that the group-VDR is an independent behavioral aspect of what is perceived as dominance and is not redundant with many other behavioral indicators of dominance.

What had been found in dyads in the laboratory (e.g., Dovidio et al. 1988a, b) thus holds for groups in the natural environment of organizational team meetings with respect to status, but not with respect to gender (Conway et al. 1996; Eagly 1987; Eagly and Karau 2002). The fact that high-status women showed the highest group-VDR potentially reflects the present demands of a Western society on its female high-status professionals—that they need to be tougher than a man to succeed at the workplace (Koch 2004). The gap in visual dominance behavior between high- and low-status women may partly reflect the pressure on professional women to make a choice: Do they want to be a traditional (low status) woman or a modern (high status) woman? Accordingly, the visual dominance behavior that they manifest may be more submissive or more dominant. In contrast, men seem to be inclined to display a similar amount of visual dominance independent of their status. In sum, although visual dominance behavior depended mainly on status, it was influenced by gender "through the backdoor", in the form of interactions and influences on the group-level as shown by MLA.

Why would the gender prediction (i.e., the main effect of sex on group-VDR), not be confirmed? There are three major reasons we can think of: First, the integration of female leaders into work contexts is so far advanced by now that the formerly found *man-dominance relation* in gaze behavior disappeared. With the abundance of high group-VDR in high status women and in teams with a higher percentage of women, non-conscious nonverbal gaze signals revealed a rather progressive role distribution in this sample. Second, results might also partially be due to the fact that this study did not examine situations in which individuating information was virtually absent, as is often the case in laboratory studies, but from a situation where participants have known one another for years. Participants, and especially high-status persons, were not "tabula rasa" for their colleagues. Instead, they had acquired multifaceted information about one another over time. Therefore, visual dominance behavior was likely based on factors other than gender, such as for instance, expertise (Berger et al. 1974; Fiske et al. 1999; Fiske and Neuberg 1990). And finally, new findings may now have resulted, because with new and more accurate methods of analysis we captured information on the group-level, i.e., information that may vary across teams.

Visual Egalitarianism: Balanced Gaze Distribution among Team Members

Correlations of the gaze distribution index with measures related to egalitarianism indicated small but significant relations. The more balanced the gaze distribution, the more the participants perceived their team as democratic, flat in hierarchy, gender fair, and the more they had higher work satisfaction and greater feelings of being able to be their true selves at the workplace. Since we used single items as dependent variables, however, the reliability is compromised in cases other than perceived authenticity and gender fairness.

Instead of the predicted difference in the visual egalitarianism patterns between men and women on level 1, we found a significant influence of sex on level 2 on the GDI: If the team leader was a woman, the balanced gaze distribution in the entire team was higher (these were also the teams with a higher percentage of women). For participants with a male team leader, the gaze distribution was more polarized and thus less egalitarian (i.e., gaze was distributed to fewer team members). By employing more "indirect gaze" (Kestenberg Amighi et al. 1999), teams with female leaders may thus create an atmosphere of more egalitarian participation. The GDI may further be related to the expectation of a reaction from the team member attended to. Possibly, in teams high in balanced gaze distribution, it is an explicit aim to evoke reactions or feedback from team members on the topic under discussion to ensure their participation, commitment, and work motivation (cf. Knapp and Hall 1992). Status had no effect on the GDI.

The Gaze of (In-)Equality

In sum, the study suggests status and gender differences in visual dominance: High status members and particularly high status women displayed higher group-VDR than low status members; and participants with female leaders showed a more balanced gaze distribution than participants with male leaders who distributed their gaze preferentially among fewer persons. Thus, female gender was positively related to both equality and inequality in gaze behavior. Multilevel analyses proved helpful in identifying the influence of grouping as shown by substantial intra-class correlation, significant group-level variables, and the amount of explained variance for both dependent variables, respectively.

Limitations of the study include the small sample size: we observed 17 teams with 94 participants, which is at the lower limit for performing multilevel analyses in general (Tabachnick and Fidell 2007). In addition, we had to deal with unequal group sizes in different teams, and the fact that targets were not always visible (see "Appendix A"). Furthermore, we do not mean to suggest that the group-VDR and the GDI should be used in every study in which dominance and egalitarianism are of interest. In the case of dominance, for example, researchers in many cases can, and should, use the much simpler measure of perceived dominance to obtain an estimate of individual dominance instead of going through such intensive coding as we did in this study—particularly, since the group visual dominance ratio is related to perceived dominance of the group members as evidenced in this study. However, if it is of interest to determine the particular cues used to come to a specific dominance judgment, we need valid research findings that provide hints about behavioral operationalizations of the concepts of interest. This is one of the main purposes of our research. In addition, correlations between detailed observations of visual dominance and global dominance judgments were not very high ($r = .24$; $p < .05$), indicating that the latent construct of dominance is only partially captured by the behavioral or self-report measures employed here.

Further Research Directions

Lobel (1999), in an overview of the research on benefits and outcomes of gender-related team diversity at the workplace, found heterogeneous results which did not allow for clear conclusions. Likewise, we are not at the point of making practical suggestions on the basis of our data yet. Future studies should clarify whether the group-VDR, as defined in this study, is a valid measure of dominance across contexts. Although our correlational findings provide a first validation, more evidence is needed from field as well as laboratory contexts. In addition to more specific tests of the influence of status on group-VDR, one could hypothesize that more pronounced gender effects on group-VDR would emerge in laboratory settings, where—in contrast to our study—team members are not acquainted with one another (cf. Fiske et al. 1999; Fiske and Neuberg 1990). Research should further investigate whether the GDI, as defined in this study, is a valid measure for egalitarianism across contexts, and how exactly it is related to attention and affect, to name just two. Positive correlations with other measures provide initial support for balanced gaze distribution as a measure of egalitarianism. However, more evidence is needed from different types of studies. While status had no effect on GDI, future research may focus on the potential influence of time pressure, task type, and task difficulty on GDI, and on its influence on team performance and effectiveness. In addition, the influence of group size and sex of members with token status should be examined more explicitly (Deaux and LaFrance 1998; Deaux and Major 1987; Kanter 1977; Yoder 1991). Since gaze behavior is subject to cultural display rules as well, it would be of further interest to investigate cross-cultural differences on the measures developed.

This study investigated gaze behavior in actual work groups within the context of the groups' regular team meetings in organizations. It contributed methodological tools for analyzing gaze behavior related to dominance- and egalitarianism and assessed the relation of those concepts to gender and status of participants. Status and sex of team members in relation with status, as well as team sex composition influenced specific dominance-related gaze patterns (i.e., group-VDR). The sex of the leader, alternatively, influenced a more versus less balanced gaze-distribution among team members as a specific gaze pattern related to egalitarianism (i.e., GDI). The study developed possibilities for extending and further validating analyses of visual dominance behavior and introduced a procedure for assessing visual egalitarianism. Gender and status are important moderators of behavior in many contexts. Focusing on their nonverbal aspects as transmitted by gaze behavior, the study sheds light on meaningful implicit characteristics of everyday communication.

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Appendix A

Details on the Development of the Group-VDR

Example: For a group of three persons, Formula 2 would be applied as follows (lwt = looks while talking; lwl = looks while listening; gr = group):

$$\frac{\frac{\text{A lwt B}+\text{A lwt C}+\text{A lwt gr}}{\text{A talk B}+\text{A talk C}+\text{A talk gr}+\text{A talk away}}\times 100}{\frac{\text{A lwl B}+\text{A lwl C}+\text{A lwl gr}}{\text{B talk A}+\text{B talk C}+\text{B talk gr}+\text{B talk away}+\text{C talk A}+\text{C talk}+\text{B}+\text{C talk gr}+\text{C talk away}}\times 100}$$

Missing data due to occasional lack of visibility of some group members and their absence from part of the meeting (e.g., for an incoming phone call) caused us to adjust the group-VDR calculations in two steps: (a) to adjust for lack of visibility, we used the following formula (Formula 4; group-VDR considering out-of-sight times):

$$\frac{\frac{A\ lwt\ total-(A\ lwt\ away+away\ \%\ of\ lwt\ without\ sight)}{A\ talk\ total}\times 100}{\frac{A\ lwl\ total-(A\ lwl\ away+away\ \%\ of\ lwl\ without\ sight)}{talk\ total\ group\ without\ A}\times 100},$$

(b) when out-of-sight times and absence times occurred simultaneously, the following formula provided an adequate solution (Formula 5; group-VDR considering out-of-sight and absence times)

$$\frac{\frac{A\ lwt\ total-(A\ lwt\ away+away\ \%\ of\ lwt\ without\ sight)}{A\ talk\ total}\times 100}{\frac{A\ lwl\ total-(A\ lwl\ away+away\ \%\ of\ lwl\ without\ sight)}{talk\ total\ group\ without\ A-\text{talk}\ \%\ \text{total group in absence time(s)}}\times 100}$$

Ad Formula 4: Some persons were sometimes covered by other persons. In these cases we coded the speaking mode (*lwt* or *lwl*), yet, the gaze direction, i.e., the target person looked at, needed to be inferred. Presupposing that persons show a similar gaze behavior when they are not visible compared to when they are visible, we chose Formula 4. For example, to calculate ‘away % of lwl without sight’ for person C from team X we proceeded in the following way: person C from team X was in lwl-mode for 14,604 frames. She looked away for 2,715 frames. For 465 frames she was out of sight (*oS*). The total time that C was in lwl-mode and at the same time visible, thus, amounted to 14,604 − 465 = 11,889 frames. In about 23% of this time she looked away (away = 2,715). Assuming that she would display a similar gaze pattern for the time that she was out-of-sight, we presupposed that she would look away for 23% of the out-of-sight-time as well, which amounted to 106 frames. This value was added to the total observed lwl-away-time and then subtracted from the total listening-time. *Lwt*-values were treated respectively.

Ad Formula 5: Further modifications in calculating the group-VDR were necessary when person A joined the team meeting at a later point, left at an earlier point, or intermittently left the room, for example, for a phone call. These absence times needed to be taken into account for group-VDR calculations for the absent person in the value ‘*talk* total group without A’. The assumption was that the *lwt*-behavior of the whole group during the absence times is proportional to the *lwt*-behavior of the whole group during the entire observation time. The computations changed as shown in Formula 5.

We calculated the total value of group’s lwt without A in proportion to the entire time of a session in Formula 4. This percent value was the value multiplied with A’s out-of-sight time. The result was the estimator for A's lwt time while out of sight which was subtracted from the overall values. Hence, the resulting value 'talk total group without A' considered the out-of-sight times. When out-of-sight and absence times occurred both at a time Formula 5 provided an adequate solution. Depending on the circumstances encountered, the appropriate formula needs to be chosen (with formula parts in italics flexibly applied).

Technical specifications: A frontal view of all participants allows to compute the group-VDR as precisely as possible. One overall perspective is preferable to split-screen taping, because it increases target accuracy.

Appendix B

Mathematical Derivation of the Gaze Distribution Index (GDI) for a Person p

We calculated the GDI-value of a person as the sum of the absolute differences of this person looking at each other team member and the maximum balanced gaze distribution (i.e., each team member is looked at for the exact same amount of time). The most unbalanced value would result for a person looking at only one person during the entire time. This value, however, is still influenced by group size. In order to get a standardized GDI_p-value we calculated the maximum polarized gaze distribution for each possible group size using the Manhattan norm, and divided the empirically derived values by this maximum value for standardization purposes. Resulting GDI_p-values were reversed in polarization and lay then between 0 polarized and 1 balanced.

Note: In the following mathematical derivation $n =$ number of persons in the team; t_i is the standardized time that the person p looks at another person p_i, *for* $i = 1,\ldots, n-1$. ($n - 1$ being the standardized time)

Each person p is assigned a GDI-value GDI_p (i.e., a standardized measure for the gaze distribution of the person p) with the following attributes:

$$0 \leq \mathrm{GDI}_p \leq 1$$

a. $\mathrm{GDI}_p = 1$ for balanced gaze distribution, i.e., each other person in the team is looked at for the exact same amount of time: $\frac{1}{n-1}$
b. $\mathrm{GDI}_p = 0$ for maximum polarized gaze distribution, i.e., person p looks at only one person during the entire time;

To obtain a standardized measure of egalitarianism we used the Manhattan norm

$$\sum_{i=1}^{n-1} \left| \frac{1}{n-1} - t_i \right|$$

(the sum of the absolute differences of $\frac{1}{n-1}$ as the balanced gaze distribution and t_i the actual standardized gazing time). For maximum balanced gaze results

$$\sum_{i=1}^{n-1} \left| \frac{1}{n-1} - \frac{1}{n-1} \right| = 0,$$

and for maximum polarized gaze, i.e., only one person is gazed at for the entire time:

$$\left|\frac{1}{n-1}-1\right|+\sum_{i=1}^{n-2}\left|\frac{1}{n-1}-0\right|=1-\frac{1}{n-1}+\frac{n-2}{n-1}=2\times\frac{n-2}{n-1}.$$

A standardized GDI-value (between 0 and 1), fulfilling the conditions (a) to (c), results from

$$GDI_p=1-\frac{\sum_{i=1}^{n-1}\left|\frac{1}{n-1}-t_i\right|}{2\times\frac{n-2}{n-1}}=1-\frac{n-1}{2(n-2)}\times\sum_{i=1}^{n-1}\left|\frac{1}{n-1}-t_i\right|$$

After reversal of polarities, GDI-values lie between 0 polarized and 1 balanced.

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