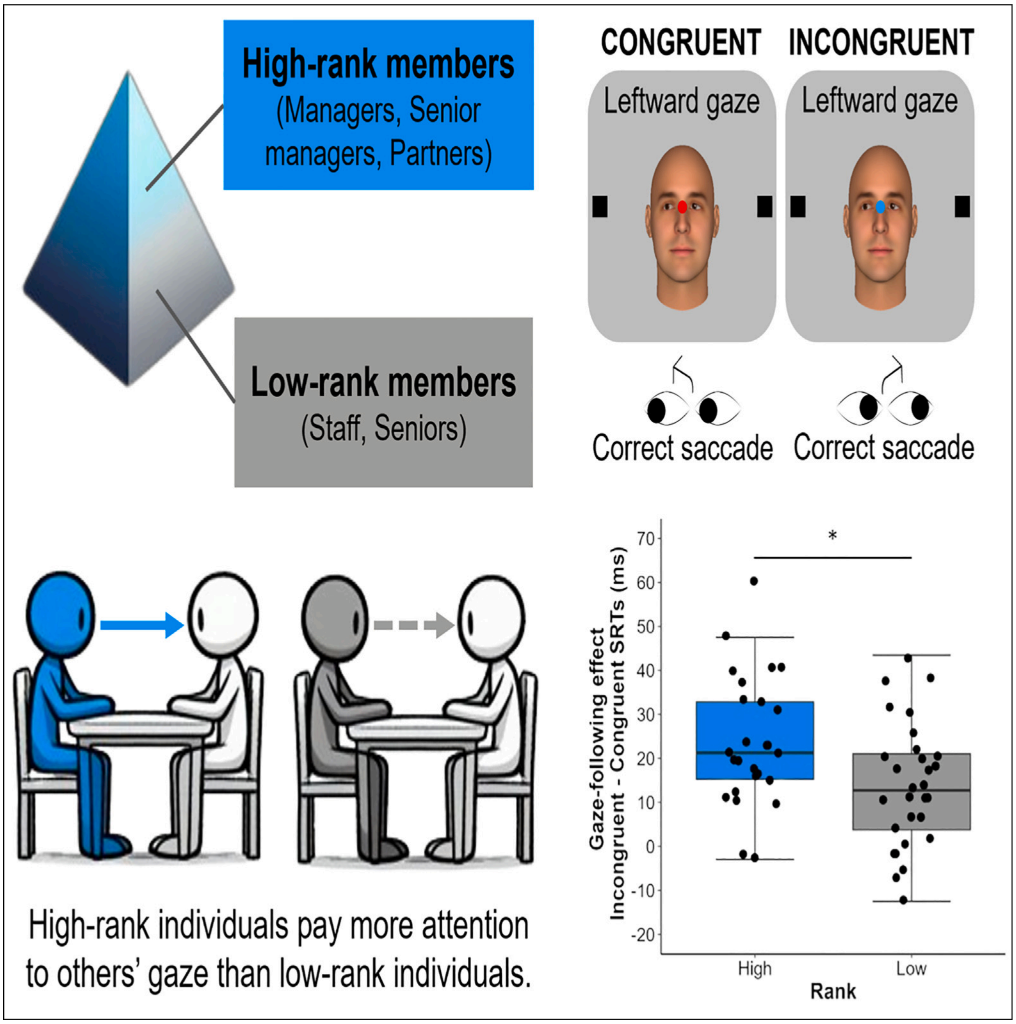
iScience

CellPress
OPEN ACCESS

Article

Leading through gaze: Enhanced social attention in high-rank members of a large-scale organization



Giorgia Ponsi, Michael Schepisi, Donato Ferri, Francesco Bianchi, Chiara Consiglio, Laura Borgogni, Salvatore Maria Aglioti

giorgia.ponsi@iit.it (G.P.)
salvatoremaria.aglioti@uniroma1.it (S.M.A.)

Highlights

Primate research shows that social attention is affected by the gazer's social rank

Low- and high-rank human members of a large-scale organization were recruited

Social attention to other's gaze is greater in high-rank than low-rank individuals

Humans' hierarchical rank affects their permeability to social information

Ponsi et al., iScience 27, 111129
November 15, 2024
https://doi.org/10.1016/j.isci.2024.111129

iScience

CellPress
OPEN ACCESS

Article

Leading through gaze: Enhanced social attention in high-rank members of a large-scale organization

Giorgia Ponsi,[1,2,6,7,*] Michael Schepisi,[3,6] Donato Ferri,[4,5] Francesco Bianchi,[4,5] Chiara Consiglio,[4] Laura Borgogni,[4] and Salvatore Maria Aglioti[1,2,*]

SUMMARY

Human attention is naturally directed where others are looking. Primate research indicates that this phenomenon is influenced by the social rank of the gazer. Whether this applies to human societies remains underexplored. Diverging from the typical approach based on transient social rank manipulations in convenience samples, we tested low- and high-rank individuals permanently working in a large-scale organization. Participants executed saccades toward positions matching or not the gaze direction of distractor faces varying in dominance level (low, neutral, and high). The analysis of saccadic reaction time revealed that high-rank participants were more interfered by face distractors, regardless of dominance. Our results suggest that an important feature of leadership is related to the fine-tuning of social attention. These findings not only contribute to understanding how hierarchical rank shapes social cognition but also have implications for organizational behavior and leadership training strategies.

INTRODUCTION

Specialized brain systems have evolved in non-human and human primates to process social signals coming from different sources, such as faces,[1] bodies,[2] odors,[3] biological sounds,[4] and motion.[5] In the domain of social visual processing, studies evidenced a stable human preference for the processing of social information (e.g., eyes, faces, and body parts). In fact, compared to non-social stimuli, social stimuli are detected[6,7] and discriminated[8] more accurately and quickly.[9]

The allocation of attentional resources to other human beings or parts of the environment they attend to is pivotal for inferring their intentions or developing emotional reactions toward them.[10] In everyday social interactions, monitoring another individual's gaze is adaptive for various reasons, i.e., detecting salient environmental information, sharing attentional states, or actively directing each other's attention.[11] This phenomenon, called gaze following, occurs when individuals automatically shift their attention in the direction in which other individuals are looking to follow their gaze.[12,13] Gaze-following behavior is a direct index of social or joint attention, defined as the cognitive process that underlies gazing at or with another person[14] and as the ability to share and coordinate attentional states with a social partner.[15] Importantly, joint attention occurs both overtly, when actual eye movements are performed (gaze-following tasks), and covertly, through automatic and implicit shifts of spatial attention (gaze-cueing tasks[16–18]). Social attention may reflect actual social competence skills[19] and represent an endophenotype of autism spectrum disorder.[20] Consistently, both gender and autism spectrum quotient have been found to influence the degree of attention paid to social stimuli, with male participants and individuals scoring higher on the autism quotient, exhibiting weaker cueing effects.[21]

Although gaze following is an automatic-reflexive behavior in which another's oculomotor pattern is imitated,[22] mounting evidence shows how both stimulus-driven and top-down mechanisms can affect social attention orientation. Studies indicate that social attention can be influenced by the physical characteristics of the face the observer is attending to, like gender,[23] age,[24] masculinity/dominance,[25] emotional expression,[26–28] self-similarity,[29] or presence of eye contact.[30] For example, attention is oriented faster to target stimuli presented at spatial locations cued vs. miscued by the eye gaze of dominant faces in a gaze-cueing task.[25]

As for top-down mechanisms, social attention orientation can be influenced by higher-order socio-cognitive variables like familiarity,[31,32] goal relevance,[13] group membership,[33,34] political affiliation,[35–39] and, crucial to the present study, social status.[40] Indeed, information related to social status, i.e., the relative rank of an individual along one or more social dimensions within a given social hierarchy,[41] may be able to modulate the observer's attentional orientation. From an evolutionary point of view, the ability to quickly and accurately infer the status of

[1]Sapienza University of Rome and Center for Life Nano- & Neuro-Science, Italian Institute of Technology, Rome, Italy
[2]IRCCS Santa Lucia Foundation, Rome, Italy
[3]Department of Human Sciences, Verona University, Verona, Italy
[4]Department of Psychology, Sapienza University of Rome, Rome, Italy
[5]Ernst & Young, Rome, Italy
[6]These authors contributed equally
[7]Lead contact
*Correspondence: giorgia.ponsi@iit.it (G.P.), salvatoremaria.aglioti@uniroma1.it (S.M.A.)
https://doi.org/10.1016/j.isci.2024.111129

another individual represents an essential skill for effectively navigating through social hierarchies.[42] Crucially, gaze following increases the probability of attending to important social processes, such as cooperation, competition, or rank reversals, thus helping individuals to keep track of the existing relationships among the group members.[11]

Evidence from primate studies suggests that the social status of both the observer and the observed individual modulates the strength and timing of gaze-following behavior. In particular, low-status rhesus macaques reflexively followed the gaze of all familiar individuals, while high-status macaques selectively followed the gaze of other high-status individuals.[43] This effect has been replicated in a gaze-cueing study involving humans, where participants were presented with faces of individuals whose CVs they had previously read, identified them as having low or high-social status.[40] The authors found that participants shifted faster their attention in response to the averted gaze of high-status but not low-status individuals.[40]

Furthermore, it has been shown that only the faces of individuals consistently behaving as leaders (but not followers), elicited the gaze-cueing effect.[44] Similarly, individuals leading natural group interactions were looked at more, looked less toward other individuals, and elicited more mutual gaze, suggesting that gaze can be considered as a marker of leadership.[45] It is worth noting that in all the aforementioned studies, information about individuals' social status was provided to the participants. Interestingly, social status information can also be spontaneously inferred from verbal and non-verbal behavior observed in brief dynamic group interactions.[46,47] Experimental evidence shows that individuals who were attributed high social status were fixated more often, for longer on each gaze, and for a longer total time, compared to people perceived as medium or low social status.[48] Also, naive observers looking at real team meetings gazed at emergent leaders more often and for longer with respect to non-leaders.[49] Notably, the reverse effect may also take place, with humans using gaze-following behavior as an indicator of social status and social relevance.[50,51]

While research has mainly manipulated the stimulus-driven or top-down information related to the faces that served as experimental stimuli for gaze-cueing tasks, only few studies have investigated the social status of the observers. Previous studies found that, compared with participants primed with high social power, those primed with low social power displayed a stronger gaze-cueing effect.[52] Also, faces with a historically privileged social identity (European American/"White") elicited gaze following from both White and Black observers, whereas faces with a historically underprivileged social identity (African American/"Black") only elicited gaze following from Black participants (study 1).[53] Similarly, White faces elicited gaze following from both low- and high-power White observers, whereas Black faces only elicited gaze following from low-power White observers (study 2).[53] These findings align with previous evidence showing that Black participants shift their attention in response to the averted gaze of both ingroup and outgroup faces, while White participants only respond to the averted gaze of ingroup faces[33] and are more interfered by White faces.[34] Notably, cross-cultural differences in perceived social status may be associated with distinct patterns of oculomotor interference[54] and gaze cueing.[55]

Typically, transient human ranking manipulations are conducted using role-playing,[56,57] social comparison,[58,59] or priming[52] procedures on convenience samples. One significant aspect of this study is the recruitment of participants who are permanently employed in low- and high-ranking positions within a real-world organization (see Tables 1 and 2). Further, we also manipulated the dominance level displayed by the face distractors, which consisted of computer-reconstructed faces[60] (see Figure 1 and STAR Methods, method details, Stimuli).

This approach allowed us to dissociate the role of the social status of the observers from the one ascribed to the identities employed in the gaze-following task. Participants were required to execute saccadic eye movements in the direction signaled by a colored fixation dot. The direction of the instructed saccade could match (congruent trials) or not (incongruent trials) the direction of the gaze made by face distractors, expressing low, neutral, or high dominance (see Figure 2 and STAR Methods, method details, Procedure).

In agreement with previous research,[23,25] we expected that our participants will shift faster their attention in response to the averted gaze of high-dominant but not low-dominant faces. No specific hypotheses on the role of the observer's rank in modulating gaze-following behavior were advanced because this type of effect was observed only in non-human primates.[43]

RESULTS

Details about pre-processing of eye tracking data can be found in the STAR Methods, method details, Data handling. For statistical analyses, we only kept correct saccades, i.e., congruent with the instructions given by the cue (n_{total} = 13,582), and excluded the incorrect ones (n_{total} = 694, 5.1%). No differences emerged between high and low-rank participants with respect to the frequency of correct and incorrect saccades (χ^2 (df = 1, n = 14276) = 0.35, p = 0.55). Descriptive analyses revealed that the data were normally distributed (all Shapiro-Wilk p values >0.46) and their variances were equal (all Levene's p values >0.05).

Gaze-following behavior is affected by the observer's rank

We calculated the *Gaze-following effect* by subtracting the *Saccadic Reaction Time* (SRT) of congruent trials from the SRT of incongruent trials (as given in the study by Jones B.C. et al., Liuzza M.T. et al., Cazzato V. et al., Liuzza M.T. et al., and Porciello G. et al.[25,35–38]). Thus, more positive scores indicated stronger gaze-following effect—or stronger interfering power exerted by the face distractors—while more negative scores indicated weaker gaze-following effect or weaker interfering power exerted by the face distractors. We ran a 3 (*Dominance*: low, neutral, high) by 2 (*Rank*: low, high) mixed ANOVA on the continuous dependent variable *Gaze-following effect*. To rule out any possible confounding effects due to the presence of only masculine distractor stimuli, we included participants' *Gender* as a control variable. Similarly, since age-related differences in the reflexive components of overt gaze following have been found,[61] we included *Age* as a control variable too. Results revealed a main effect of *Rank* ($F(1,51) = 6.63$, $p = 0.013$, $\eta^2 = 0.067$, $\eta_p^2 = 0.115$, $\eta^2_G = 0.068$, $\omega^2 = 0.051$), indicating that high-rank individuals presented a stronger gaze-following effect with respect to low-rank individuals (mean difference = 11.38,

Table 1. Descriptive statistics of demographic data and self-report measures in high- and low-rank groups

	High rank (n = 26) Mean ± SD (%)	Low rank (n = 29) Mean ± SD (%)
Demographic data		
Age	38.19 ± 6.79 years	31.76 ± 6.30 years
Age range	28-53 years	25-51 years
Gender	16 male (61.54%)	12 male (41.38%)
Self-report measures		
QCAE Total score	89.31 ± 9.41	93.41 ± 7.99
QCAE Cognitive empathy	58.15 ± 8.27	58.69 ± 6.07
QCAE Affective empathy	31.15 ± 5.31	34.72 ± 5.26
QCAE Perspective taking	32.00 ± 4.69	31.28 ± 4.14
QCAE Online simulation	26.15 ± 4.76	27.41 ± 3.30
QCAE Emotion contagion	9.27 ± 2.71	10.55 ± 2.76
QCAE Proximal responsivity	11.35 ± 1.94	12.17 ± 1.91
QCAE Peripheral responsivity	10.54 ± 2.80	12.00 ± 2.66
BFQ Extraversion	3.95 ± 0.61	3.72 ± 0.45
BFQ Agreeableness	4.06 ± 0.45	4.19 ± 0.48
BFQ Conscientiousness	4.12 ± 0.62	4.00 ± 0.61
BFQ Neuroticism	3.53 ± 0.71	3.38 ± 0.67
BFQ Openness	3.99 ± 0.57	4.20 ± 0.36
MLQ Transformational	3.98 ± 0.49	NA
MLQ Transactional	3.59 ± 0.35	NA

Self-reports' acronyms are: QCAE = Questionnaire of Cognitive and Affective Empathy, BFQ = Big Five Questionnaire, MLQ = Multifactor Leadership Questionnaire.

SE = 4.42, t = 2.58, p = 0.013, 95% confidence interval [CI] [2.51, 20.25], Cohen's d = 0.585, see Figure 3) (see Table 3 for descriptive statistics). We found no other significant main effects or interactions (all Fs < 0.65, ps >0 .48).

Gaze-following behavior correlates with self-report measures of empathy and personality in low-rank individuals

To explore whether gaze-following behavior was modulated by participants' self-reported empathy skills (QCAE) and personality traits (BFQ) for the two groups (i.e., high and low-rank participants), we run Pearson's correlations between these scores and the *Gaze-following effect*, in

Table 2. Independent samples t tests between high- and low-rank groups for QCAE and BFQ scores

Self-report scores	t (df = 53)	p	Cohen's d	SE Cohen's d
QCAE Total score	−1.749	0.086	−0.472	0.278
QCAE Cognitive empathy	−0.276	0.784	−0.074	0.270
QCAE Affective empathy	−2.501	0.016*	−0.675	0.286
QCAE Perspective taking	0.608	0.546	0.164	0.271
QCAE Online simulation	−1.150	0.255	−0.311	0.273
QCAE Emotion contagion	−1.737	0.088	−0.469	0.278
QCAE Proximal responsivity	−1.591	0.118	−0.430	0.277
QCAE Peripheral responsivity	−1.984	0.052†	−0.536	0.280
BFQ Extraversion	1.537	0.130	0.415	0.276
BFQ Agreeableness	−0.969	0.337	−0.262	0.273
BFQ Conscientiousness	0.731	0.468	0.197	0.271
BFQ Neuroticism	0.773	0.443	0.209	0.272
BFQ Openness	−1.695	0.096	−0.458	0.277

Self-reports' acronyms are: QCAE = Questionnaire of Cognitive and Affective Empathy, BFQ = Big Five Questionnaire. *p < 0.05, †p < 0.10.

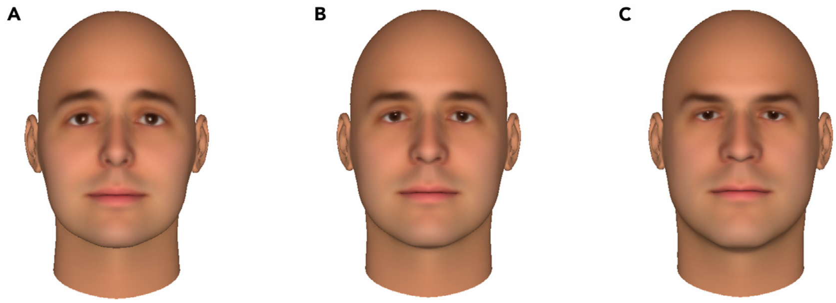


Figure 1. Face distractors
Example of the computer-reconstructed faces selectively manipulated for the dominance trait[60] employed as face distractors in the gaze-following task.
(A) Low dominance (−3 SD).
(B) Neutral (0 SD).
(C) High dominance (+3 SD).
SD = standard deviation.

which we averaged the low, high, and neutral dominance levels to obtain a single numerical variable. Results showed that for low-rank participants' *Gaze-following effect* was positively related to the Cognitive Empathy subscale of the QCAE ($r = 0.42$, $p = 0.023$, Fisher's $z = 0.449$, see Figure 4A), indicating a stronger gaze-following effect for the low-rank participants who were more inclined to understand and recognize others' emotional experiences and feelings, using visual, auditory, and situational cues.[62] In addition, we observed the same positive association with the BFQ's Agreeableness (r = 0.46, $p = 0.012$, Fisher's $z = 0.499$, see Figure 4B) and Neuroticism ($r = 0.47$, $p = 0.011$, Fisher's $z = 0.505$, see Figure 4C) traits, indicating that those more inclined to friendliness and emotional stability were also more interfered by human faces during the task.

Conversely, we found no significant correlations for high-rank participants, indicating that their stronger gaze-following effect (compared to low-rank participants, as observed in the previous analysis) was not modulated by individual differences captured by the employed self-report measures. For the high-rank group only, we also tested whether gaze-following behavior was modulated by participants' leadership type, thus we ran Pearson's correlations with the Multifactor Leadership Questionnaire (MLQ) subscale scores and the *Gaze-following effect*. No significant correlation emerged, for both leadership styles (transformational: $r = 0.12$, $p = 0.63$; transactional: $r = -0.02$, $p = 0.92$).

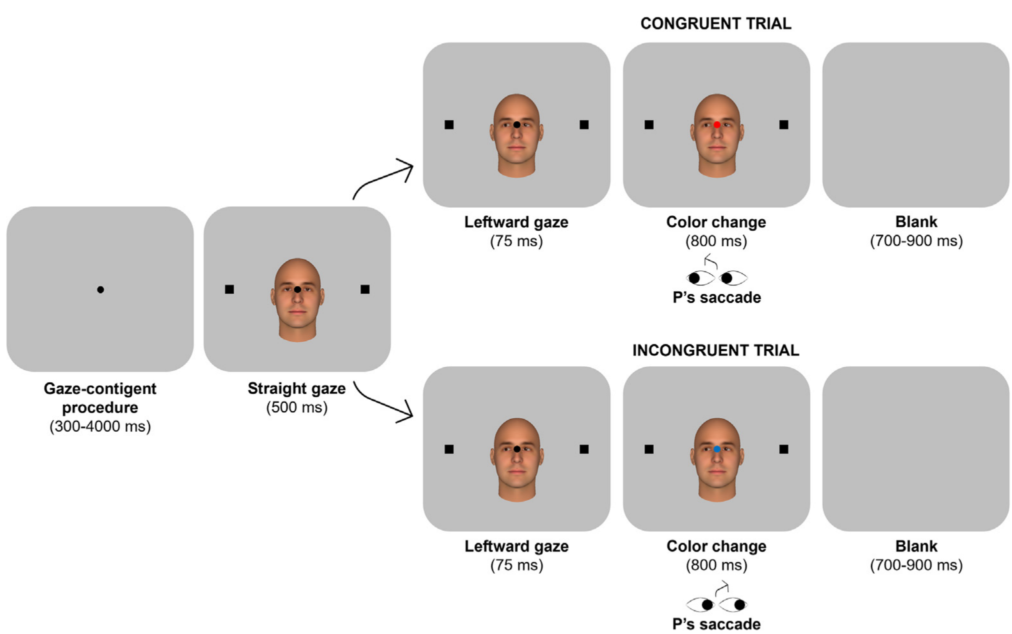


Figure 2. Gaze-following task
Schematic representation and timeline of the gaze-following task, with a neutral dominance face stimulus. The upper row depicts a congruent trial, with the red dot signaling to perform a leftward saccade and the face gazing left. The lower row depicts an incongruent trial, with the blue dot signaling to perform a rightward saccade and the face gazing left. Participant (P)'s saccade depicts the correct direction toward which the eye movement should be directed. Please note that stimuli are not drawn to scale.

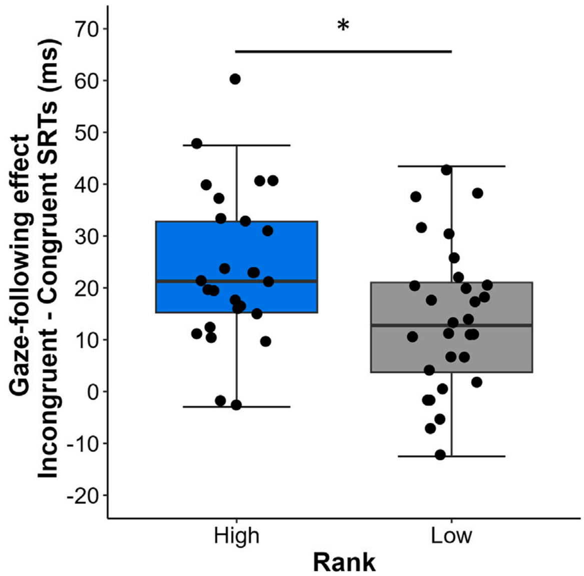


Figure 3. Gaze-following behavior is greater in high-rank than low-rank individuals

Boxplot of the main effect of Rank on the gaze-following effect (milliseconds). Dots show individual mean values (high-rank: $n = 26$; low-rank: $n = 29$), solid horizontal line inside the box indicates the median, and the lower and upper hinges of the boxplot correspond to the 25th and 75th percentiles, respectively. The lower and upper whiskers extend to the most extreme data point within 1.5 times the interquartile range (IQR, the distance between the 25th and the 75th percentiles).

DISCUSSION

In this study, we investigated the conjugate effects of the observer's rank and the stimuli's facial dominance on saccadic reaction time during a gaze-following task. At variance with previous research,[23,25] we found no effects of facial dominance on gaze-following behavior. It is worth noting, however, that recent studies reported null effects of perceived dominance of human-like faces on gaze-cueing[63] and gaze-leading.[64] The absence of gaze modulation could be ascribed to the employment of computer-generated faces that could capture attention less efficiently with respect to real human faces because they are rated as less familiar[65] and human-like[66] or could be less salient compared with face identities with high individual relevance (e.g., the conspecifics' faces employed with non-human primates[43]). Moreover, previous studies, in which significant effects of facial dominance emerged, were gaze-cueing tasks requiring participants to perform hand motor responses[23,25] and not gaze-following tasks requiring participants to perform saccadic eye movements. Since manual motor responses require more time to be executed with respect to saccadic eye movements, dominance facial cues may exert stronger interference effects with the formers. In line with this explanation, recent research found that saccadic responses were not affected by facial expression and identity cues, while manual response latencies were sensitive to facial emotional expressions.[67]

One main result of the present study is that high-rank individuals showed a stronger gaze-following effect with respect to low-rank ones. In other words, high-rank individuals were more interfered by the gaze displayed by face distractors when performing saccadic eye movements during the task. This result does not fully align with previous findings, reporting that individuals primed with high social power exhibit weaker gaze-cueing effect[52] and that increasing the power felt by privileged social groups (e.g., White perceivers) made their gaze-following sensitive only to ingroup, but not outgroup, gazers.[53] These studies employed transient human ranking manipulations on convenience samples, while our participants permanently hold low- and high-ranking positions in a real-world organization.

Table 3. Descriptive statistics of gaze-following effect (milliseconds) in high- and low-rank groups, at different levels of face distractors' dominance

Rank	Dominance	Mean	SD	Minimum	Maximum
High	High	22.110	14.760	−1.794	50.521
Low	High	10.884	22.770	−36.883	70.595
High	Low	23.718	21.512	−10.052	78.426
Low	Low	16.160	17.146	−11.108	56.507
High	Neutral	25.510	21.633	−10.951	84.524
Low	Neutral	14.905	15.979	−10.023	53.705

Mean, standard deviation, minimum, and maximum values are reported.

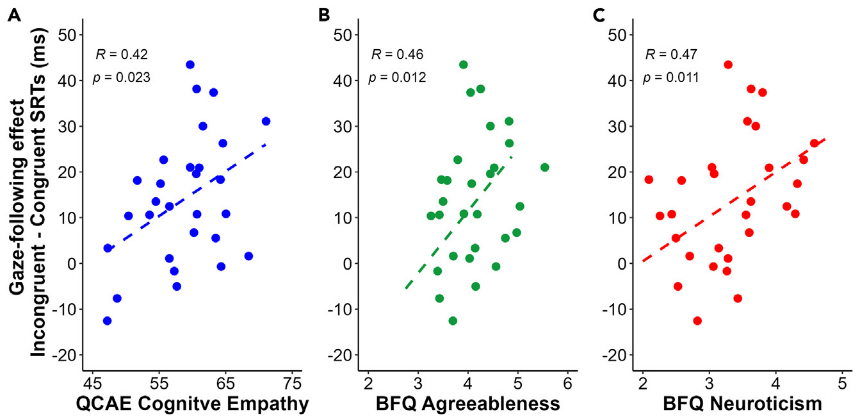


Figure 4. Correlations between gaze-following behavior and self-report measures of empathy and personality in low-rank individuals
Correlation plots depicting the linear relationship between the gaze-following effect (milliseconds) and the mean scores of (i) QCAE Cognitive Empathy (A), (ii) BFQ Agreeableness (B), (iii) BFQ Neuroticism (C), in low-rank participants ($n = 29$). For each plot, statistical information (R = correlation coefficient, p = statistical significance) relative to the relationship between the two variables and a best-fit regression line are also depicted. Type of correlation test: Pearson.

Furthermore, it is plausible that the high-rank participants that took part in our study (i.e., managers, senior managers, and partners) may be particularly sensitive to social cues and inclined toward social interactions due to their job requirements. In fact, they interact and communicate daily with team members, co-workers, and clients in high-stakes and high-pressure environments. These ecological characteristics may enhance their receptivity to social information. Of note, studies indicate that chief operating officers' (CEOs) personality (especially conscientiousness, agreeableness, and extraversion) and values are crucial determinants of organizational culture.[68] However, whether organizational practices shape CEOs' personalities and social skills remains to be explored.

To the best of our knowledge, no previous study employed low- and high-rank members of a social hierarchy as participants in a gaze-following task (see the study by Shepherd S.V. et al.[43] for findings involving non-human primates). Previous studies found that more dominant individuals were more reluctant to avert their gaze from stimuli that depict dominance, including angry faces[69] and body postures.[70] Eye-directed gaze seems to act as a charismatic signal.[71] In fact, participants' self-reported charisma predicted the frequency and duration of gaze directed at their followers during simulated leadership scenarios.[72] Moreover, longer and more frequent gazing induced leaders to be perceived as more prototypical of their position,[72] to receive higher approval and ratings of effectiveness (in terms of charisma, dominance, assertivity, and competence) from their employees and also to elicit in them extra-effort at work[71] (for a review on eye gaze and social attention in leadership and followership see the study by Cheng J.T. et al.[73]).

Our result also suggests that high-rank individuals' attention may be more permeable to social information with respect to low-rank ones. In line with this idea, previous research found that leaders seem hypervigilant to social signs displayed on others' faces. In particular, prestige-oriented (but not dominance-oriented) leaders overperceived facial expressions of social discontent and disapproval (experiments 1 and 2).[74] Also, manipulations of prestige induced similar behavioral patterns, suggesting that an orientation toward prestige causes leaders to have social perception biases (experiments 3, 4, and 5).[74] These attention/perception biases may be consistent with the idea that being hypervigilant to (negative) social signals may allow leaders to quickly identify social disapproval and take actions aimed at managing and enhancing social relationships within a group, decreasing the probability of losing others' endorsement.[74] It is worth mentioning that social class has been found to affect the neural correlates of spontaneous trait inference. In particular, in high socio-economic status (SES) individuals the event-related potential (ERP) N400 was observed in response to incongruent face/traits pairings during a lexical decision task, while in low SES individuals N400 was not present.[75,76] These findings suggest that high-rank individuals may be more inclined to spontaneously infer traits when presented with social information. Furthermore, a study investigating 800 senior managers showed that "high flyers" (i.e., the individuals who rose faster to the top of their organizations) presented elevated scores in several indicators, including social functioning.[77]

The results of our study may also imply that high-rank individuals may be more prone or prepared to social interaction with respect to low-rank ones. Crucially, grouped pedestrians exhibited greater gaze following toward a confederate compared to solitary ones,[27] and high-power individuals (i.e., individuals who scored higher in dominance or were assigned control over resources in decision-making dyads) showed enhanced behavioral approach system activation (e.g., enhanced social perception, expression of attitudes and more positive emotional experience) compared to low-power participants.[78] Similarly, another study focusing on the neuroendocrine and cardiovascular correlates of social standing[79] found that higher social status (both measured and manipulated) was associated with approach-oriented physiological reactivity (e.g., higher testosterone, greater cardiac output and heart rate, lower pre-ejection period, and lower respiratory sinus arrhythmia) during a stress task.[80] These findings are in line with the approach/inhibition theory of power according to which power leads to a more active approach system and a less active inhibition system.[81]

We suggest that the enhanced gaze-following behavior observed in high-rank individuals may be linked with enhanced attentional orientation toward social stimuli. Importantly, to assess whether joint attention (i.e., following the direction of another's gaze) reflects social processing ability, the effects of gender and autism spectrum quotient on gaze cueing have been measured. Male participants pay less attention to social stimuli compared to female ones, as demonstrated by the lesser influence played by face distractors in affecting the performance of the formers. Additionally, a negative correlation between autism spectrum quotient and gaze-cueing was observed; in particular, individuals scoring higher on the autism quotient (i.e., those having poorer social and communication skills) tend to produce less joint attention when viewing gaze shifts.[21] This suggests that a stronger gaze-cueing effect may index more advanced social skills.

Importantly, previous studies investigated the effects of traits that may characterize distinct leadership styles on gaze-following behavior. For example, the type of relationship (e.g., cooperative or competitive) established during a previous interaction with a cueing face modulated gaze-following behavior. In particular, female participants with low and average levels of competition displayed an enhanced gaze-cueing effect for competitive than cooperative contenders.[82]

Our data also showed that low-rank individuals performed saccadic eye movements quicker than high-rank ones in a gaze-following task, suggesting that they were less interfered by face distractors. This result is in agreement with an electroencephalography study showing that low-status participants monitor their performance more actively (as signaled by an enhanced medial frontal negativity), and adjust their behavior more effectively when they receive a negative performance feedback.[83] Furthermore, previous evidence indicates that socially excluded participants exhibit a weaker gaze-cueing effect compared to socially included ones, likely because the former perceive averted gaze as a rejection signal.[84] Since low-rank participants may experience social exclusion more frequently than high-rank ones,[85,86] they may also exhibit reduced gaze following toward faces displaying non-affiliative intentions (i.e., faces that look away). Interestingly, low-rank participants who were more friendly (BFQ Agreeableness), more emotionally stable (BFQ Neuroticism), and more inclined to understand and recognize others' emotions (QCAE Cognitive Empathy) presented an oculomotor performance which was more like that of high-rank ones (i.e., they were more interfered from face distractors).

To conclude, this study provided valuable insights into the effect of hierarchical standing on social attention orientation. In particular, we showed that high-rank individuals working in a hierarchically structured company presented a stronger gaze-following behavior, in line with previous evidence suggesting that leaders direct others' attention by means of a greater ability to gaze-lead and to maintain rather than break eye contact when stared by others.[73] Our findings also confirm that gaze following may be conceived as a conditionally automatic process, modulated by contextually relevant social information,[87,88] including the observer's position within a social hierarchy.

Importantly, oculomotor parameters recorded in eye tracking studies may represent general indicators of interpersonal dynamics (for a review see the study by Rahal R.M. and Fiedler S.[89]), including social ranking. The evaluation of human gaze behavior in real-world corporations may have practical implications for the assessment of organizational social relationships[90] and for the emergence of the organizational neuroscience research field.[91,92]

Limitations of the study

Our research has some limitations. The study was exploratory because the only evidence of gaze following being influenced by the observer's rank derived from non-human primates,[43] which have distinct social motivation,[93] typical group size,[94] and a less complex social structure[95] with respect to humans. Accordingly, no specific hypotheses associated with the observer's rank were advanced for humans. Another limitation regards the employment of computer-generated faces instead of real human faces with personal relevance for our participants. Also, we only employed male identities as face distractors. Therefore, our results cannot be extended to female gazers. Future studies are needed to clarify whether the gazer's gender plays a role in capturing the social attention of low- and high-rank individuals. Additionally, we interpreted our findings in terms of enhanced reactivity to social cues of high-vs. low-rank participants. However, future research should focus on the measurement of actual social skills (e.g., by employing the Social Skills subscale of the autism-spectrum quotient (AQ[96]), to assess whether social attention and social competence may be linked (as given in the study by Laidlaw K.E.W et al. and Edward S.G. et al.[19,97]).

RESOURCE AVAILABILITY

Lead contact

Requests for further information and resources should be directed to and will be fulfilled by the Lead Contact, Giorgia Ponsi (giorgia.ponsi@iit.it; giorgia.ponsi@gmail.com).

Materials availability

This study did not generate new unique reagents.

Data and code availability

- Data have been deposited at Open Science Framework (OSF): https://osf.io/jr7zk/ and Mendeley Data: https://doi.org/10.17632/7nz2tjgvj2.2, as specified in the key resources table.
- All original code has been deposited at Open Science Framework (OSF): https://osf.io/jr7zk/ and Mendeley Data: https://data.mendeley.com/datasets/7nz2tjgvj2/2, https://doi.org/10.17632/7nz2tjgvj2.2), as specified in the key resources table.
- Any additional information required to reanalyze the data reported in this paper is available from the lead contact upon request.

ACKNOWLEDGMENTS

The present work was funded by a European Research Council (ERC) Advanced Grant 2017 awarded to SMA (grant number: ERC-2017-AdG – eHONESTY – 789058) and by Sapienza University Grants awarded to SMA (grant number RM120172B1FFBF09 and RG12117A7B3801EB).

AUTHOR CONTRIBUTIONS

Conceptualization, G.P., M.S., D.F., F.B., C.C., L.B., and S.M.A.; methodology, G.P. and M.S.; software, G.P. and M.S.; validation, G.P. and M.S.; formal analysis, G.P. and M.S.; investigation, G.P. and M.S.; resources, D.F. and F.B.; data curation, G.P. and M.S.; writing – original draft, G.P. and M.S.; writing – review and editing, G.P., M.S., D.F., F.B., C.C, L.B., and S.M.A; visualization, G.P. and M.S.; supervision, L.B. and S.M.A.; project administration, G.P., M.S., and F.B., funding acquisition, S.M.A.

DECLARATION OF INTERESTS

The authors declare no competing interests.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this work, the authors used ChatGPT (https://chatgpt.com/) for proofreading and Microsoft Designer (https://designer.microsoft.com/) to create elements of the graphical abstract. After using these tools, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

STAR★METHODS

Detailed methods are provided in the online version of this paper and include the following:

- KEY RESOURCES TABLE
- EXPERIMENTAL MODEL AND STUDY PARTICIPANT DETAILS
  - Participants
- METHOD DETAILS
  - Stimuli
  - Apparatus
  - Procedure
  - Data handling
- QUANTIFICATION AND STATISTICAL ANALYSIS

Received: June 19, 2024
Revised: August 9, 2024
Accepted: October 4, 2024
Published: October 10, 2024

REFERENCES

1. Kanwisher, N., and Yovel, G. (2006). The fusiform face area: A cortical region specialized for the perception of faces. Phil. Trans. R. Soc. B. *361*, 2109–2128. https://doi.org/10.1098/rstb.2006.1934.
2. de Gelder, B., Van den Stock, J., Meeren, H.K., Sinke, C.B., Kret, M.E., and Tamietto, M. (2010). Standing up for the body. Recent progress in uncovering the networks involved in the perception of bodies and bodily expressions. Neurosci. Biobehav. Rev. *34*, 513–527. https://doi.org/10.1016/j.neubiorev.2009.10.008.
3. Mutic, S., Brünner, Y.F., Rodriguez-Raecke, R., Wiesmann, M., and Freiherr, J. (2017). Chemosensory danger detection in the human brain: Body odor communicating aggression modulates limbic system activation. Neuropsychologia *99*, 187–198. https://doi.org/10.1016/j.neuropsychologia.2017.02.018.
4. Geangu, E., Quadrelli, E., Lewis, J.W., Macchi Cassia, V., and Turati, C. (2015). By the sound of it. An ERP investigation of human action sound processing in 7-month-old infants. Dev. Cogn. Neurosci. *12*, 134–144. https://doi.org/10.1016/j.dcn.2015.01.005.
5. Pavlova, M.A. (2012). Biological motion processing as a hallmark of social cognition. Cerebr. Cortex *22*, 981–995. https://doi.org/10.1093/cercor/bhr156.
6. Purcell, D.G., and Stewart, A.L. (1988). The face-detection effect : configuration enhances detection. Percept. Psychophys. *43*, 355–366.
7. Jiang, Y., Costello, P., and He, S. (2007). Processing of Invisible Stimuli. Advantage of Upright Faces and Recognizable Words in Overcoming Interocular Suppression. Psychol. Sci. *18*, 349–355.
8. Lehky, S.R. (2000). Fine discrimination of faces can be performed rapidly. J. Cognit. Neurosci. *12*, 848–855. https://doi.org/10.1162/089892900562453.
9. Ro, T., Friggel, A., and Lavie, N. (2007). Attentional biases for faces and body parts. Vis. cogn. *15*, 322–348. https://doi.org/10.1080/13506280600590434.
10. Adolphs, R. (2010). Conceptual Challenges and Directions for Social Neuroscience. Neuron *65*, 752–767. https://doi.org/10.1016/j.neuron.2010.03.006.
11. Zuberbühler, K. (2008). Gaze following. Curr. Biol. *18*, R453–R455. https://doi.org/10.1016/j.cub.2008.03.015.
12. Shepherd, S.V. (2010). Following gaze: Gaze-following behavior as a window into social cognition. Front. Integr. Neuroscience *4*, 1–13. https://doi.org/10.3389/fnint.2010.00005.
13. Ricciardelli, P., Carcagno, S., Vallar, G., and Bricolo, E. (2013). Is gaze following purely reflexive or goal-directed instead? Revisiting the automaticity of orienting attention by gaze cues. Exp. Brain Res. *224*, 93–106. https://doi.org/10.1007/s00221-012-3291-5.
14. Richardson, D.C., and Gobel, M.S. (2015). Social attention. In The handbook of attention, J.M. Fawcett, E.F. Risko, and A. Kingstone, eds. (The MIT Press), pp. 349–367.
15. Mundy, P., and Newell, L. (2007). Attention, joint attention, and social cognition. Curr. Dir. Psychol. Sci. *16*, 269–274. https://doi.org/10.1111/j.1467-8721.2007.00518.x.
16. Friesen, C.K., and Kingstone, A. (1998). The eyes have it! Reflexive orienting is triggered by nonpredictive gaze. Psychon. Bull. Rev. *5*, 490–495. https://doi.org/10.3758/BF03208827.
17. Driver, J., Davis, G., Ricciardelli, P., Kidd, P., Maxwell, E., and Baron-Cohen, S. (1999). Gaze perception triggers reflexive visuospatial orienting. Vis. cogn. *6*, 509–540. https://doi.org/10.1080/135062899394920.
18. Hietanen, J.K., and Leppaenen, J.M. (2003). Does Facial Expression Affect Attention Orienting by Gaze Direction Cues? J. Exp. Psychol. Hum. Percept. Perform. *29*, 1228–1243.
19. Laidlaw, K.E.W., Foulsham, T., Kuhn, G., and Kingstone, A. (2011). Potential social interactions are important to social attention. Proc. Natl. Acad. Sci. USA *108*, 5548–5553. https://doi.org/10.1073/pnas.1017022108.
20. Tiede, G.M., and Walton, K.M. (2021). Social endophenotypes in autism spectrum disorder: A scoping review. Dev. Psychopathol. *33*, 1381–1409. https://doi.org/10.1017/S0954579420000577.
21. Bayliss, A.P., Pellegrino, G.D., and Tipper, S.P. (2005). Sex differences in eye gaze and symbolic cueing of attention. Q. J. Exp. Psychol. Sect. A Hum. Exp. Psychol. *58*,

631–650. https://doi.org/10.1080/02724980443000124.
22. Ricciardelli, P., Bricolo, E., Aglioti, S.M., and Chelazzi, L. (2002). My eyes want to look where your eyes are looking: Exploring the tendency to imitate another individual's gaze. Neuroreport *13*, 2259–2264. https://doi.org/10.1097/00001756-200212030-00018.
23. Ohlsen, G., van Zoest, W., and van Vugt, M. (2013). Gender and Facial Dominance in Gaze Cuing: Emotional Context Matters in the Eyes That We Follow. PLoS One *8*, e59471. https://doi.org/10.1371/journal.pone.0059471.
24. Ciardo, F., Marino, B.F.M., Actis-Grosso, R., Rossetti, A., and Ricciardelli, P. (2014). Face age modulates gaze following in young adults. Sci. Rep. *4*, 4746. https://doi.org/10.1038/srep04746.
25. Jones, B.C., DeBruine, L.M., Main, J.C., Little, A.C., Welling, L.L.M., Feinberg, D.R., and Tiddeman, B.P. (2010). Facial cues of dominance modulate the short-term gaze-cuing effect in human observers. Proc. R. Soc. A B. *277*, 617–624. https://doi.org/10.1098/rspb.2009.1575.
26. Tipples, J. (2006). Fear and fearfulness potentiate automatic orienting to eye gaze. Cognit. Emot. *20*, 309–320. https://doi.org/10.1080/02699930500405550.
27. Gallup, A.C., Chong, A., Kacelnik, A., Krebs, J.R., and Couzin, I.D. (2014). The influence of emotional facial expressions on gaze-following in grouped and solitary pedestrians. Sci. Rep. *4*, 5794–5813. https://doi.org/10.1038/srep05794.
28. Bonifacci, P., Ricciardelli, P., Lugli, L., and Pellicano, A. (2008). Emotional attention: Effects of emotion and gaze direction on overt orienting of visual attention. Cognit. Process. *9*, 127–135. https://doi.org/10.1007/s10339-007-0198-3.
29. Hungr, C.J., and Hunt, A.R. (2012). Physical self-similarity enhances the gaze-cueing effect. Q. J. Exp. Psychol. *65*, 1250–1259. https://doi.org/10.1080/17470218.2012.690769.
30. Dalmaso, M., Alessi, G., Castelli, L., and Galfano, G. (2020). Eye contact boosts the reflexive component of overt gaze following. Sci. Rep. *10*, 4777–4810. https://doi.org/10.1038/s41598-020-61619-6.
31. Deaner, R.O., Shepherd, S.V., and Platt, M.L. (2007). Familiarity accentuates gaze cuing in women but not men. Biol. Lett. *3*, 64–67. https://doi.org/10.1098/rsbl.2006.0564.
32. Dalmaso, M., Edwards, S.G., and Bayliss, A.P. (2016). Re-encountering individuals who previously engaged in joint gaze modulates subsequent gaze cueing. J. Exp. Psychol. Learn. Mem. Cogn. *42*, 271–284. https://doi.org/10.1037/xlm0000159.
33. Pavan, G., Dalmaso, M., Galfano, G., and Castelli, L. (2011). Racial group membership is associated to gaze-mediated orienting in Italy. PLoS One *6*, e25608. https://doi.org/10.1371/journal.pone.0025608.
34. Dalmaso, M., Galfano, G., and Castelli, L. (2015). The Impact of Same- and Other-Race Gaze Distractors on the Control of Saccadic Eye Movements. Perception *44*, 1020–1028. https://doi.org/10.1177/0301006615594936.
35. Liuzza, M.T., Cazzato, V., Vecchione, M., Crostella, F., Caprara, G.V., and Aglioti, S.M. (2011). Follow My Eyes: The Gaze of Politicians Reflexively Captures the Gaze of Ingroup Voters. PLoS One *6*, e25117. https://doi.org/10.1371/journal.pone.0025117.
36. Cazzato, V., Liuzza, M.T., Caprara, G.V., Macaluso, E., and Aglioti, S.M. (2015). The attracting power of the gaze of politicians is modulated by the personality and ideological attitude of their voters: A functional magnetic resonance imaging study. Eur. J. Neurosci. *42*, 2534–2545. https://doi.org/10.1111/ejn.13038.
37. Liuzza, M.T., Vecchione, M., Dentale, F., Crostella, F., Barbaranelli, C., Caprara, G.V., and Aglioti, S.M. (2013). A look into the ballot box: Gaze following conveys information about implicit attitudes toward politicians. Q. J. Exp. Psychol. *66*, 209–216. https://doi.org/10.1080/17470218.2012.754909.
38. Porciello, G., Liuzza, M.T., Minio-Paluello, I., Caprara, G.V., and Aglioti, S.M. (2016). Fortunes and misfortunes of political leaders reflected in the eyes of their electors. Exp. Brain Res. *234*, 733–740. https://doi.org/10.1007/s00221-015-4496-1.
39. Carraro, L., Dalmaso, M., Castelli, L., and Galfano, G. (2015). The politics of attention contextualized: gaze but not arrow cuing of attention is moderated by political temperament. Cognit. Process. *16*, 309–314. https://doi.org/10.1007/s10339-015-0661-5.
40. Dalmaso, M., Pavan, G., Castelli, L., and Galfano, G. (2012). Social status gates social attention in humans. Biol. Lett. *8*, 450–452. https://doi.org/10.1098/rsbl.2011.0881.
41. Mattan, B.D., Kubota, J.T., and Cloutier, J. (2017). How Social Status Shapes Person Perception and Evaluation: A Social Neuroscience Perspective. Perspect. Psychol. Sci. *12*, 468–507. https://doi.org/10.1177/1745691616677828.
42. Cummins, D.D. (2000). How the social environment shaped the evolution of the mind. Synthese *122*, 3–28.
43. Shepherd, S.V., Deaner, R.O., and Platt, M.L. (2006). Social status gates social attention in monkeys. Curr. Biol. *16*, 119–120. https://doi.org/10.1098/rsbl.2011.0881.
44. Capozzi, F., Becchio, C., Willemse, C., and Bayliss, A.P. (2016). Followers Are Not Followed: Observed Group Interactions Modulate Subsequent Social Attention. J. Exp. Psychol. Gen. *145*, 531–535. https://doi.org/10.1037/xge0000167.supp.
45. Capozzi, F., Beyan, C., Pierro, A., Koul, A., Murino, V., Livi, S., Bayliss, A.P., Ristic, J., and Becchio, C. (2019). Tracking the Leader: Gaze Behavior in Group Interactions. iScience *16*, 242–249. https://doi.org/10.1016/j.isci.2019.05.035.
46. Brand, C.O., and Mesoudi, A. (2019). Prestige and dominance-based hierarchies exist in naturally occurring human groups, but are unrelated to task-specific knowledge. R. Soc. Open Sci. *6*, 181621. https://doi.org/10.1098/rsos.181621.
47. Cheng, J.T., Tracy, J.L., Foulsham, T., Kingstone, A., and Henrich, J. (2013). Two ways to the top: Evidence that dominance and prestige are distinct yet viable avenues to social rank and influence. J. Pers. Soc. Psychol. *104*, 103–125. https://doi.org/10.1037/a0030398.
48. Foulsham, T., Cheng, J.T., Tracy, J.L., Henrich, J., and Kingstone, A. (2010). Gaze allocation in a dynamic situation: effects of social status and speaking. Cognition *117*, 319–331.
49. Gerpott, F.H., Lehmann-Willenbrock, N., Silvis, J.D., and Van Vugt, M. (2018). In the eye of the beholder? An eye-tracking experiment on emergent leadership in team interactions. Leader. Q. *29*, 523–532. https://doi.org/10.1016/j.leaqua.2017.11.003.
50. Emery, N.J. (2000). The eyes have it: The neuroethology, function and evolution of social gaze. Neurosci. Biobehav. Rev. *24*, 581–604.
51. Chudek, M., Heller, S., Birch, S., and Henrich, J. (2012). Prestige-biased cultural learning: bystander's differential attention to potential models influences children's learning. Evol. Hum. Behav. *33*, 46–56. https://doi.org/10.1016/j.evolhumbehav.2011.05.005.
52. Cui, G., Zhang, S., and Geng, H. (2014). The impact of perceived social power and dangerous context on social attention. PLoS One *9*, e1140777. https://doi.org/10.1371/journal.pone.0114077.
53. Weisbuch, M., Pauker, K., Adams, R.B., Lamer, S.A., and Ambady, N. (2017). Race, power, and reflexive gaze following. Soc. Cognit. *35*, 619–638. https://doi.org/10.1521/soco.2017.35.6.619.
54. Zhang, X., Dalmaso, M., Castelli, L., Fu, S., and Galfano, G. (2021). Cross-cultural asymmetries in oculomotor interference elicited by gaze distractors belonging to Asian and White faces. Sci. Rep. *11*, 20410–20411. https://doi.org/10.1038/s41598-021-99954-x.
55. Zhang, X., Dalmaso, M., Castelli, L., Fiorese, A., Lan, Y., Sun, B., Fu, S., and Galfano, G. (2021). Social attention across borders: A cross-cultural investigation of gaze cueing elicited by same- and other-ethnicity faces. Br. J. Psychol. *112*, 741–762. https://doi.org/10.1111/bjop.12476.
56. Mendelson, T., Thurston, R.C., and Kubzansky, L.D. (2008). Affective and Cardiovascular Effects of Experimentally-Induced Social Status. Health Psychol. *27*, 482–489. https://doi.org/10.1037/0278-6133.27.4.482.
57. Kraus, M.W., and Mendes, W.B. (2014). Sartorial symbols of social class elicit class-consistent behavioral and physiological responses: A dyadic approach. J. Exp. Psychol. Gen. *143*, 2330–2340. https://doi.org/10.1037/xge0000023.
58. Pieritz, K., Süssenbach, P., Rief, W., and Euteneuer, F. (2016). Subjective social status and cardiovascular reactivity: An experimental examination. Front. Psychol. *7*, 1–6. https://doi.org/10.3389/fpsyg.2016.01091.
59. Gong, X., and Sanfey, A.G. (2017). Social rank and social cooperation: Impact of social comparison processes on cooperative decision-making. PLoS One *12*, 01754722. https://doi.org/10.1371/journal.pone.0175472.
60. Oosterhof, N.N., and Todorov, A. (2008). The functional basis of face evaluation. Proc. Natl. Acad. Sci. USA *105*, 11087–11092. https://doi.org/10.1073/pnas.0805664105.
61. Kuhn, G., Pagano, A., Maani, S., and Bunce, D. (2015). Age-related decline in the reflexive component of overt gaze following. Q. J. Exp. Psychol. *68*, 1073–1081. https://doi.org/10.1080/17470218.2014.975257.
62. Di Girolamo, M., Giromini, L., Winters, C.L., Serie, C.M.B., and de Ruiter, C. (2019). The Questionnaire of Cognitive and Affective Empathy: A Comparison Between Paper-and-Pencil Versus Online Formats in Italian Samples. J. Pers. Assess. *101*, 159–170.

https://doi.org/10.1080/00223891.2017.1389745.
63. Mattavelli, G., Romano, D., Young, A.W., and Ricciardelli, P. (2021). The interplay between gaze cueing and facial trait impressions. Q. J. Exp. Psychol. *74*, 1642–1655. https://doi.org/10.1177/17470218211007791.
64. Edwards, S.G., Rudrum, M., McDonough, K.L., and Bayliss, A.P. (2022). The influence of social and emotional context on the gaze leading orienting effect. Vis. cogn. *30*, 54–69. https://doi.org/10.1080/13506285.2021.1980169.
65. Di Natale, A.F., Simonetti, M.E., La Rocca, S., and Bricolo, E. (2023). Uncanny valley effect: A qualitative synthesis of empirical research to assess the suitability of using virtual faces in psychological research. Comput. Hum. Behav. Rep. *10*, 100288. https://doi.org/10.1016/j.chbr.2023.100288.
66. Miller, E.J., Foo, Y.Z., Mewton, P., and Dawel, A. (2023). How do people respond to computer-generated versus human faces? A systematic review and meta-analyses. Comput. Hum. Behav. Rep. *10*, 100283. https://doi.org/10.1016/j.chbr.2023.100283.
67. Kveraga, K., Im, H.Y., Ward, N., and Adams, R.B. (2020). Fast saccadic and manual responses to faces presented to the koniocellular visual pathway. J. Vis. *20*, 9–11. https://doi.org/10.1167/jov.20.2.9.
68. O'Reilly, C., Cao, X., and Sull, D. (2023). CEO Personality: The Cornerstone of Organizational Culture? Group Organ. Manag. 1–37. https://doi.org/10.1177/10596011231176591.
69. Terburg, D., Hooiveld, N., Aarts, H., Kenemans, J.L., and van Honk, J. (2011). Eye tracking unconscious face-to-face confrontations: Dominance motives prolong gaze to masked angry faces. Psychol. Sci. *22*, 314–319. https://doi.org/10.1177/0956797611398492.
70. Hortensius, R., Van Honk, J., De Gelder, B., and Terburg, D. (2014). Trait dominance promotes reflexive staring at masked angry body postures. PLoS One *9*, e1162322. https://doi.org/10.1371/journal.pone.0116232.
71. Liegl, S., Maran, T., Kraus, S., Furtner, M., and Sachse, P. (2024). Eyes that Lead: The charismatic influence of gaze signaling on employee approval and extra-effort. J. Bus. Res. *183*, 114861. https://doi.org/10.1016/j.jbusres.2024.114861.
72. Maran, T., Furtner, M., Liegl, S., Kraus, S., and Sachse, P. (2019). In the eye of a leader: Eye-directed gazing shapes perceptions of leaders' charisma. Leader. Q. *30*, 101337. https://doi.org/10.1016/j.leaqua.2019.101337.
73. Cheng, J.T., Gerpott, F.H., Benson, A.J., Bucker, B., Foulsham, T., Lansu, T.A., Schülke, O., and Tsuchiya, K. (2023). Eye gaze and visual attention as a window into leadership and followership: A review of empirical insights and future directions. Leader. Q. *34*, 101654. https://doi.org/10.1016/j.leaqua.2022.101654.
74. Case, C.R., Bae, K.K., Larsen, K.T., and Maner, J.K. (2021). The Precautious Nature of Prestige: When Leaders Are Hypervigilant to Subtle Signs of Social Disapproval. J. Pers. Soc. Psychol. *120*, 694–715. https://doi.org/10.1037/pspi0000284.
75. Varnum, M.E.W., Na, J., Murata, A., and Kitayama, S. (2012). Social class differences in N400 indicate differences in spontaneous trait inference. J. Exp. Psychol. Gen. *141*, 518–526. https://doi.org/10.1037/a0026104.
76. Varnum, M.E.W. (2016). The Emerging (Social) Neuroscience of SES. Soc. Personal. Psychol. Compass *10*, 423–430. https://doi.org/10.1111/spc3.12258.
77. Jensen, T.M. (2007). High flyers: What sets them apart? A study of personality and reasoning in 800 senior managers. EWOP Pract *1*, 4–9. https://doi.org/10.21825/ewopinpractice.87049.
78. Anderson, C., and Berdahl, J.L. (2002). The experience of power: Examining the effects of power on approach and inhibition tendencies. J. Pers. Soc. Psychol. *83*, 1362–1377. https://doi.org/10.1037/0022-3514.83.6.1362.
79. Hamilton, L.D., Carré, J.M., Mehta, P.H., Olmstead, N., and Whitaker, J.D. (2015). Social Neuroendocrinology of Status: A Review and Future Directions. Adapt. Hum. Behav. Physiol. *1*, 202–230. https://doi.org/10.1007/s40750-015-0025-5.
80. Akinola, M., and Mendes, W.B. (2014). It's Good to Be the King: Neurobiological Benefits of Higher Social Standing. Soc. Psychol. Personal. Science *5*, 43–51. https://doi.org/10.1177/1948550613485604.
81. Keltner, D., Gruenfeld, D.H., and Anderson, C. (2003). Power, Approach, and Inhibition. Psychol. Rev. *110*, 265–284. https://doi.org/10.1037/0033-295X.110.2.265.
82. Ciardo, F., Ricciardelli, P., Lugli, L., Rubichi, S., and Iani, C. (2015). Eyes keep watch over you! Competition enhances joint attention in females. Acta Psychol. *160*, 170–177. https://doi.org/10.1016/j.actpsy.2015.07.013.
83. Boksem, M.A.S., Kostermans, E., Milivojevic, B., and De cremer, D. (2012). Social status determines how we monitor and evaluate our performance. Soc. Cogn. Affect. Neurosci. *7*, 304–313. https://doi.org/10.1093/scan/nsr010.
84. Capellini, R., Riva, P., Ricciardelli, P., and Sacchi, S. (2019). Turning away from averted gazes: The effect of social exclusion on gaze cueing. Front. Psychol. *10*, 1000. https://doi.org/10.3389/fpsyg.2019.01000.
85. Manstead, A.S.R. (2018). The psychology of social class: How socioeconomic status impacts thought, feelings, and behaviour. Br. J. Soc. Psychol. *57*, 267–291. https://doi.org/10.1111/bjso.12251.
86. Ermagun, A., and Erinne, J. (2022). A systematic exclusion induced by institutional ranking in engineering faculty hiring: Introducing a cycle of winners and losers. PLoS One *17*, e0275861. https://doi.org/10.1371/journal.pone.0275861.
87. Dalmaso, M., Castelli, L., and Galfano, G. (2020). Social modulators of gaze-mediated orienting of attention: A review. Psychon. Bull. Rev. *27*, 833–855. https://doi.org/10.3758/s13423-020-01730-x.
88. Zhang, X., Dalmaso, M., Galfano, G., and Castelli, L. (2023). Tuning social modulations of gaze cueing via contextual factors. Psychon. Bull. Rev. *30*, 1004–1010. https://doi.org/10.3758/s13423-022-02211-z.
89. Rahal, R.M., and Fiedler, S. (2019). Understanding cognitive and affective mechanisms in social psychology through eye-tracking. J. Exp. Soc. Psychol. *85*, 103842. https://doi.org/10.1016/j.jesp.2019.103842.
90. Cyr, A.A., Le Breton-Miller, I., and Miller, D. (2023). Organizational Social Relations and Social Embedding: A Pluralistic Review. J. Manag. *49*, 474–508. https://doi.org/10.1177/01492063221117120.
91. Boukarras, S., Ferri, D., Frisanco, A., Farnese, M.L., Consiglio, C., Alvino, I., Bianchi, F., D'Acunto, A., Borgogni, L., and Aglioti, S.M. (2022). Bringing social interaction at the core of organizational neuroscience. Front. Psychol. *13*, 1–7. https://doi.org/10.3389/fpsyg.2022.1034454.
92. Boukarras, S., Ferri, D., Borgogni, L., and Aglioti, S.M. (2024). Neurophysiological markers of asymmetric emotional contagion: implications for organizational contexts. Front. Integr. Neurosci. *18*, 1–8. https://doi.org/10.3389/fnint.2024.1321130.
93. Tomasello, M. (2023). Differences in the Social Motivations and Emotions of Humans and Other Great Apes. Hum. Nat. *34*, 588–604. https://doi.org/10.1007/s12110-023-09464-0.
94. David-Barrett, T. (2023). Human group size puzzle: Why it is odd that we live in large societies. R. Soc. Open Sci. *10*, 230559. https://doi.org/10.1098/rsos.230559.
95. Dunbar, R.I.M. (2020). Structure and function in human and primate social networks: implications for diffusion, network stability and health. Proc. Math. Phys. Eng. Sci. *476*, 20200446. https://doi.org/10.1098/rspa.2020.0446.
96. Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., and Clubley, E. (2001). The Autism-Spectrum Quotient (AQ): Evidence from. J. Autism Dev. Disord. *31*, 5–17.
97. Edwards, S.G., Stephenson, L.J., Dalmaso, M., and Bayliss, A.P. (2015). Social orienting in gaze leading: A mechanism for shared attention. Proc. Biol. Sci. *282*, 20151141. https://doi.org/10.1098/rspb.2015.1141.
98. Leiberg, S., and Anders, S. (2006). Chapter 23 The multiple facets of empathy: a survey of theory and evidence. Prog. Brain Res. *156*, 419–440. https://doi.org/10.1016/S0079-6123(06)56023-6.
99. Todorov, A., and Oosterhof, N. (2011). Modeling social perception of faces. IEEE Signal Process. Mag. *28*, 117–122. https://doi.org/10.1109/MSP.2010.940006.
100. Crostella, F., Carducci, F., and Aglioti, S.M. (2009). Reflexive social attention is mapped according to effector-specific reference systems. Exp. Brain Res. *197*, 143–151. https://doi.org/10.1007/s00221-009-1900-8.
101. Porciello, G., Crostella, F., Liuzza, M.T., Valentini, E., and Aglioti, S.M. (2014). RTMS-induced virtual lesion of the posterior parietal cortex (PPC) alters the control of reflexive shifts of social attention triggered by pointing hands. Neuropsychologia *59*, 148–156. https://doi.org/10.1016/j.neuropsychologia.2014.04.017.
102. Dunn, M.J., Alexander, R.G., Amiebenomo, O.M., Arblaster, G., Atan, D., Erichsen, J.T., Ettinger, U., Giardini, M.E., Gilchrist, I.D., Hamilton, R., et al. (2024). Minimal reporting guideline for research involving eye tracking (2023 edition). Behav. Res. Methods *56*, 4351–4357. https://doi.org/10.3758/s13428-023-02187-1.
103. Cazzato, V., Macaluso, E., Crostella, F., and Aglioti, S.M. (2012). Mapping reflexive shifts of attention in eye-centered and hand-centered coordinate system. Hum. Brain Mapp. *33*, 165–178. https://doi.org/10.1002/hbm.21202.
104. Reniers, R.L.E.P., Corcoran, R., Drake, R., Shryane, N.M., and Völlm, B.A. (2011). The QCAE: A questionnaire of cognitive and

affective empathy. J. Pers. Assess. *93*, 84–95. https://doi.org/10.1080/00223891.2010.528484.

105. Alessandri, G., Perinelli, E., Robins, R.W., Vecchione, M., and Filosa, L. (2020). Personality trait change at work: Associations with organizational socialization and identification. J. Pers. *88*, 1217–1234. https://doi.org/10.1111/jopy.12567.

106. Caprara, G.V., Barbaranelli, C., Borgogni, L., and Perugini, M. (1993). The "big five questionnaire": A new questionnaire to assess the five factor model. Pers. Indiv. Differ. *15*, 281–288. https://doi.org/10.1016/0191-8869(93)90218-R.

107. Avolio, B.J., and Bass, B.M. (2004). Multifactor Leadership Questionnaire. In Manual and Sampler Set, 3rd ed. (Mind Garden).

108. Crouzet, S.M., Kirchner, H., and Thorpe, S.J. (2010). Fast saccades toward faces: Face detection in just 100 ms. J. Vis. *10*, 1–17. https://doi.org/10.1167/10.4.16.

109. Campbell, J.I.D., and Thompson, V.A. (2012). MorePower 6.0 for ANOVA with relational confidence intervals and Bayesian analysis. Behav. Res. Methods *44*, 1255–1265. https://doi.org/10.3758/s13428-012-0186-0.

110. R Core Team (2023). R: A Language and Environment for Statistical Computing (R Foundation for Statistical Computing).

111. RStudio Team (2022). RStudio: Integrated Development for R. RStudio (PBT).

112. JASP Team (2024). JASP (Version 0.18.3).

113. Wickham, H. (2016). ggplot2: Elegant Graphics for Data Analysis (Springer-Verlag).

STAR★METHODS

KEY RESOURCES TABLE

REAGENT or RESOURCE	SOURCE	IDENTIFIER
Deposited data		
Data from 55 human participants and code for replication analyses	This paper; OSF; Mendeley Data.	OSF: https://osf.io/jr7zk/; Mendeley data: https://doi.org/10.17632/7nz2tjgvj2.2
Software and algorithms		
Facegen 3.1	© Singular Inversions 2024	https://facegen.com/
EyeLink® Experiment Builder	SR Research Ltd.	https://www.sr-research.com/experiment-builder/
EyeLink® Data Viewer	SR Research Ltd.	https://www.sr-research.com/data-viewer/
R (version 4.3.2)	R Core Team (2023)	https://www.r-project.org/
R Studio (version 2023.12.1)	RStudio Team (2022)	https://posit.co/download/rstudio-desktop/
JASP (version 0.19.0)	JASP Team (2024)	https://jasp-stats.org/
Other		
EyeLink® 1000 Plus	SR Research Ltd.	https://www.sr-research.com/eyelink-1000-plus/

EXPERIMENTAL MODEL AND STUDY PARTICIPANT DETAILS

Participants

We recruited 60 Caucasian participants (31 females, age: M = 34.4, SD = 7.17, range = 25–53), all working at the company EY, headquartered in Rome (Italy). They were divided into 32 low-rank (19 females) and 28 high-rank (11 females) participants based on their seniority within the company. In this regard, EY is organized into 5 ascending levels: Staff, Seniors, Managers, Senior Managers, and Partners. Low-rank participants comprised Staff and Seniors members of the organization, while high-rank participants comprised Managers, Senior Managers and Partners. We excluded 5 participants (2 low-rank and 3 high-rank) because of technical issues with the eye-tracker or lack of attention or motivation during the experiment. Thus, the final sample consisted of 55 participants (28 male, age: M = 34.80, SD = 7.24, age range = 25–53). They were divided into 26 high-rank and 29 low-rank participants.

See Table 1 for descriptive statistics of demographic and self-report data, and Table 2 for the independent samples t-tests. The two groups differed in Affective Empathy (a person's emotional reaction to other people's experiences that does not necessarily require cognitive understanding[98]) and marginally in Peripheral responsivity (a subcomponent of Affective Empathy indexing the emotional responsiveness to the feelings of others who are detached from responder's social context, such as protagonists in a novel or a movie[62]), with low-rank participants reporting higher scores in both measures.

All participants had normal or corrected-to-normal vision, did not have intra-cranial metal clips, suffer from epilepsy (or had relatives who suffer from this condition), use drugs, or be affected by any psychiatric or neurologic syndrome. All participants read and signed the informed consent. The study was approved by the Institutional Review Board of the Department of Psychology, Sapienza University of Rome.

METHOD DETAILS

Stimuli

We used 25 Caucasian identities, previously validated by Todorov and Oosterhof (2011),[99] as face distractors in the gaze-following task. We selected the faces whose traits were manipulated to display various levels of Dominance. Specifically, we used faces whose evaluation scores were −3 SD (non-dominant), 0 SD (neutral), and +3 SD (dominant) from the mean. In keeping with previous studies on the same issue,[23,64] we selected extreme scores (−3 SD, +3 SD) to ensure that the faces used in the study clearly represented low dominance and high dominance, rather than intermediate levels. Then, since the original faces displayed only a straight gaze, we used the same software with which they were generated (Facegen 3.1; http://facegen.com) to create faces with their gaze averted to the left and to the right. It is worth noting that, although we planned to include also female participants in the sample, we decided to employ only male identities as generating new female faces would have required further validation. Moreover, this would have implied presenting different stimuli for different participants, creating further complexity in the experimental design. To address this potential issue, we included participants' gender as a control variable in the analyses (see results section).

Apparatus

We recorded eye movements monocularly with a high-resolution infrared eye tracker, with a sampling rate of 1000 Hz (25mm lens, EyeLink 1000 Plus, SR Research). The EyeLink 1000 Plus is a dark pupil-CR tracking system, i.e., it tracks both pupil center and CR (Corneal Reflection). This allows to have access to two points of reference on the eye to separate eye movements from head movements; in fact, the positional difference between pupil center and CR changes with eye rotation, but it remains relatively constant with minor head movements. The EyeLink 1000 Plus has a spatial accuracy of 0.25–0.50° (down to 0.15°) and a resolution (RMS, root mean squared) of 0.01° (0.05° for microsaccades, i.e., saccades smaller than 1 degree of visual angle). The eye tracker, positioned at a fixed distance of 55 cm from the participants, recorded horizontal and vertical gaze position in pixels on the screen (0,0: top-left of the screen). Participants were placed in a seated position in a dimly lit room and were applied a sticker target to the middle of the forehead, to give the eye tracker an extra reference point. In fact, we employed the remote mode, in which the tracker calculates the eye-to-camera distance for each sample based on the size of the head target sticker in the camera image. Stimuli presentation was programmed and controlled through EyeLink Experiment Builder (SR Research). The task was displayed on a monitor (1920 x1080 pixels, 120 Hz refresh rate) placed behind the eye tracker.

Procedure

The task consisted of a gaze-following task,[13,17,22,38,100,101] in which participants must respond by performing saccadic eye movements instead of pressing buttons. The color background was gray (R = 180, G = 180, B = 180). Before the task, calibration and validation procedures (provided by the eye tracker manufacturer) were achieved displaying 13 targets for the participants to fixate at these coordinates [(960,540), (960,92), (960,988), (115,540), (1805,540), (115,92), (1805,92), (115,988), (1805,988), (538,316), (1382,316), (538,764), (1382,764)]. During the calibration, the pupil-CR position for each target was recorded, and the set of target and pupil-CR positions were used to compute gaze positions during the recording. To validate the calibration, eye angles computed during validation were compared to the eye angles computed during the calibration phase. Participants had to repeat the procedures until the system determined the validation was good (maximum error for each point <1°; average error <0.5°), ensuring acceptable spatial accuracy. During the recording, pupil threshold and CR values were kept constant between 75 and 100 and below 230, respectively. The methodology followed the latest reporting guidelines in eye tracking research.[102] After receiving the instructions for the task, participants completed 24 practice trials. Each trial started with a central black fixation dot (0.36 ° × 0.36 °, 16 x 16 pixels) appearing at the center of the screen (960,540). Participants had to look at the central dot and maintain their eyes on it for at least 300 ms. If they failed this gaze-contingent procedure within 4000 ms, the trial was discarded and recycled in a second moment during the experiment, and a new validation procedure was initialized. Otherwise, in case of successful fixation, a central face (15.69 ° × 14.34 °, 697 x 637 pixels) with a straight gaze appeared for 500 ms under the central dot, flanked by two small, squared targets (0.43 ° × 0.49 °, 19 x 22 pixels) placed on the left and right side of the screen. Then, depending on the experimental condition, the same face was presented for 75 ms with either a leftward or rightward gaze. This 75-ms stimulus onset asynchrony (SOA) was chosen because (i) it is associated with the highest interference with participants' oculomotor response[100,103] and (ii) gaze following is maximal at this SOA.[22,35–38] Then, the imperative cue was presented for 800 ms, turning either red or blue. If the dot was red or blue, participants had to make a leftward or a rightward saccadic movement, respectively. The association between dot color and saccade direction was counterbalanced across participants. Participants had to follow the instructions as accurately and quickly as possible without being interfered by the gazing face. Finally, a blank was presented for a random time ranging from 700 to 900 ms. Examples of trials are depicted in Figure 2.

On half of the trials, the direction of the instructed saccade matched the direction of the gaze made by the face distractor (i.e., congruent trials), on the other half there was no matching (i.e., incongruent trials). Participants performed 4 blocks, each comprising 75 trials (total = 300 experimental trials). A break was allowed every 75 trials. Before the beginning of a new block and after each break, the experimenters performed drift-checking procedures. After completing the task, participants were then asked to fill in the Questionnaire of Cognitive and Affective Empathy (QCAE[62,104]), the Big Five Questionnaire (BFQ[105,106]), and their demographic information. Additionally, for high-rank participants, their team members had to fill in the Multifactor Leadership Questionnaire (MLQ Rater Form[107]), aimed at measuring transformational and transactional leadership types. The experimental procedure took approximately 45 min and was approved by the independent Ethics Committee of the Sapienza University of Rome and was in accordance with the 1964 Declaration of Helsinki. Participants did not receive any compensation for their participation.

Data handling

Eye tracking data were pre-processed employing EyeLink Data Viewer (SR Research). Eye-movement events with velocity and acceleration thresholds above 40°/s and 8,000°/s^2, respectively, were defined as saccades. Before extracting saccadic latency, we created Areas of Interest (AOIs) to check participants' accuracy in following the instructions during the task. We drew three AOIs: the i) *central AOI* (200x200 pixels) that included the cue placed in the center of the screen, the ii) *left AOI* (350x350 pixels) that included the target placed in the left side of the screen, and the iii) *right AOI* (350x350 pixels) that included the target placed in the right side. Then, for each participant we cleaned and prepared the data according to the following pipeline: first, we removed the practice trials (*n* = 24), leaving only the experimental trials (*n* = 300). For each experimental trial, in case of multiple saccades, we only selected the first one, when it was the end event of the reaction time definition (i.e., CURRENT_SAC_IS_RT_END (= = true). Since saccadic latency faster than 100 ms could indicate saccadic motor preparation not dependent on the instruction,[108] we checked the presence of saccades with latencies <100 ms and found none. We discarded saccades containing eye blink (i.e., CURRENT_SAC_CONTAINS_BLINK = = false). Also, we retained only saccades starting from the *central AOI* and ending in the *left* or *right AOIs.*

QUANTIFICATION AND STATISTICAL ANALYSIS

To estimate the sample size needed for this study we ran an *a priori* power analysis using the software MorePower 6.0.[109] For a 2 × 3 × 2 mixed factorial design with two within-subjects factors, one with 2 levels (*Spatial congruency* between the instruction given by the cue and the distractors' gaze direction: congruent vs. incongruent), and one with 3 levels (distractor's *Dominance*: dominant, neutral, non-dominant), and one between-subjects factor with 2 levels (participants' *Rank* in the organizational hierarchy: high vs. low), with $\eta_p^2 = 0.12$ (as in the cue-target congruency by social status interaction reported in[40]), $\beta = 0.95$ and $\alpha = 0.05$, the required number of participants was 60 (30 per group).

After pre-processing, data were handled using R software (version 4.3.2)[110] via RStudio (version 2023.12.1).[111] For each participant, SRT data were averaged for each experimental condition (Spatial congruency: congruent, incongruent; Dominance: low, neutral, high). Data were analyzed using the software JASP (version 0.18.3[112]). Plots were created using the *ggplot* function (R package *ggplot2*[113]).

Details about descriptive (i.e., mean, standard deviation, minimum and maximum) and inferential (i.e., mixed ANOVAs, *p* values, and Cohen's *d*) statistics can be found in the results section, Tables 1, 2, and 3, in Figures 3 and 4. Alpha was set at 0.05.