European Journal of Social Psychology

WILEY
EASP

RESEARCH ARTICLE

From Reading to Following: Threat Contexts Influence Visual Attention to Leader-Related Information and Leader-Following

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Received: 29 May 2025 | **Revised:** 21 November 2025 | **Accepted:** 2 December 2025

Keywords: dominance | eye-tracking | gaze-cuing effect | leadership preference | prestige | visual attention

ABSTRACT

Do situational threats influence the visual processing of leadership-related information and leader-following tendencies? In two eye-tracking experiments, participants read threat-evoking or non-threat scenarios while forming impressions of leader candidates described by combinations of dominance-related or prestige-related traits. They then rated their favourability towards the leaders (Study 1, $N = 89$) or performed a gaze-following task (Study 2, $N = 61$). Both studies showed that participants fixated longer on dominant than prestigious traits in non-threatening contexts and favoured prestigious leaders over mixed and dominant leaders. However, such effects diminished in zero-sum competitive contexts. In Study 2, competition-focused contexts exhibited larger gaze-cuing effects of mixed leaders. In contrast, danger-focused contexts showed larger gaze-cuing effects of dominant leaders compared to those in the neutral context. Overall, the findings supported the ecologically adaptive perspective of leadership perception, showing that adaptively salient ecological threats biased visual attention and leader-following towards mixed and dominant leaders.

1 | Introduction

Humans often form impressions of others and calibrate leader-following decisions in adaptive and intuitive ways (Nettle and Saxe 2021). People recognize and evaluate leaders based on facial features, voice pitch and discrete characteristics (e.g., Durkee et al. 2020; Klofstad et al. 2012; Ohlsen et al. 2013) and use these cues to distinguish two fundamental strategies of status attainment and leadership—dominance and prestige (Henrich and Gil-White 2001; Van Vugt and Smith 2019). Whereas prestige leaders are generally preferred over dominance in modern society, traits signalling dominance receive a boost in support in unpredictable, adverse, threatening environments (Kakkar and Sivanathan 2017; Zhu et al. 2022). Taking an ecologically adaptive perspective, this research tested the idea that leadership perception and leader-following tendencies are not static but shift in predictable ways that reflect evolved heuristics that help people adapt to local threats and opportunities (Van Vugt and Smith 2019). This operates at a largely automatic level without deliberate considerations (Nettle and Saxe 2021). To capture the partly automatic visual attention processes, we collected eye-tracking data as participants viewed a series of leader characteristics under threatening or non-threatening contexts. We also explored potential connections between visual processing patterns and

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leader-following tendencies measured by two distinct tasks (explicit rating and gaze-cuing paradigm).

1.1 | Dominance, Prestige and the Adaptive Strategy Perspective of Leadership

Dominance and prestige constitute two fundamental routes to status and leadership in human society (Henrich and Gil-White 2001; Maner and Case 2016; McClanahan et al. 2022; Zhu et al. 2022). Unlike traditional trait-based or behaviour-based approaches to leadership, the Dominance–Prestige framework developed in evolutionary behavioural science traces leaders' traits and strategies to distinct evolutionary origins of status hierarchies (Cheng et al. 2013; Van Vugt and Smith 2019). Dominance, which is common in non-human animal groups but also persists in contemporary human societies, stems from the need to mitigate physical conflicts over limited resources in power hierarchies (Cheng and Tracy 2014; Mazur and Booth 1998). By contrast, the prestige mechanism relies on the unique human ability of efficient cultural learning from conspecific models who possess fitness-maximizing skills and knowledge (Boyd and Richerson 2005). Although dominant leaders demand followers' compliance through intimidation and coercion, prestigious leaders attract followers' voluntary deference by being knowledgeable, generous or successful (Cheng and Tracy 2014; Henrich and Gil-White 2001; Henrich et al. 2015).

Dominance and prestige are not represented by a single trait or style but distinct adaptive strategies supported by combinations of behavioural and personality traits (Durkee et al. 2020; Cheng and Tracy 2014). They are linked to, albeit not fully captured by, existing constructs in social and personality psychology (for a review and conceptual distinction, see Cheng et al. 2013). For example, dominance is associated with masculinity and physical strength (e.g., Laustsen and Petersen 2017; Wolff and Puts 2010), aggressiveness (Johnson et al. 2007), self-aggrandization and hubristic pride (Cheng et al. 2010). Prestige, by contrast, is associated with traits advertising prosociality (e.g., cooperativeness, altruism, conscientiousness and agreeableness) and authentic pride (Cheng et al. 2010; Maner and Mead 2010). Dominant individuals are viewed as highly agentic but not highly communal, whereas prestigious individuals are perceived to have high agency and communion (Cheng and Tracy 2014). Although rooted in evolutionary reasoning, the Dominance–Prestige framework has provided unique insights into wide-ranging social psychological phenomena related to status and leadership, including the emergence of informal leadership in modern task groups (Brand and Mesoudi 2019; Redhead et al. 2019), personality and pride (Cheng et al. 2010, 2013), social influence tactics (Ketterman and Maner 2021) and leader–follower dynamics (Kakkar et al. 2020).

Importantly, dominance and prestige are not mutually exclusive strategies but might coexist within most leaders in the real world (Cheng and Tracy 2014). Combining dominance and prestige is quite common in human leadership and may even characterize leadership in other primates (de Waal 1982; Garfield et al. 2019; von Rueden et al. 2014). In many primate species, the alpha males rarely rely exclusively on dominant means (outright aggression or face-to-face threats) to get what they want (de Waal 1982). Instead, it is common for them to exert influence or leverage through their central role and reputation in social networks (King et al. 2009; Lee and Yamamoto 2023). Converging findings from anthropology and group psychology showed that informal leaders in egalitarian human societies and modern team leaders tend to be characterized by both dominance and prestige (Garfield et al. 2019; Brand and Mesoudi 2019; von Rueden et al. 2014). Developmental psychological studies have shown that mixed or 'bistrategist' leadership may be deeply rooted in development. Children and adolescents who employ both prosocial and coercive strategies often fare better at resource control than those employing purely prosocial or coercive strategies. These bistrategists enjoyed high self-esteem and popularity among peers despite high aggression ratings by themselves and peers (Hawley 2002, 2003).

1.2 | Threat Contexts and Motivated Leadership Perception and Evaluation

The Dominance–Prestige framework not only describes leaders' strategies but also accounts for followers' corresponding cognitive, emotional and behavioural responses (Cheng et al. 2013; Henrich and Gil-White 2001). It is theorized that followers take situational cues into account while processing leader characteristics, which, in turn, affect their leader-following decisions in ways that maximize their fitness benefits and minimize costs in local ecology (Bastardoz and Van Vugt 2019; Lonati and Van Vugt 2024; Hoyt et al. 2009).

Given the prosocial benefits conferred by prestigious leaders and the risks of being exploited and bullied by dominant leaders, perceptual and social-judgement biases favouring prestige are expected. Indeed, individuals pay great attention to prestigious traits and prestigious leaders, ascribe higher popularity to prestigious leaders and prefer prestigious candidates in leadership choices (Case et al. 2018; Cheng et al. 2013; Liegl et al. 2024; Zhu et al. 2022). Contrastingly, pure dominance is disliked and faces backlash in human society. For example, people generally preferred prestigious leaders to overtly dominant leaders in both traditional societies (von Rueden et al. 2014) and small task groups in modern society (e.g., Cheng et al. 2013; Redhead et al. 2019). Boehm (1999) argued that dominance-signalling leadership behaviours are strongly curtailed by dominance-levelling coalitions, making them rare in traditional, small-scale societies (representative of much of human evolutionary history). Research showed that dominant leaders often face harsher punishment for their transgressions than prestigious leaders (Kakkar et al. 2020) and are even toppled by a coalition of subordinates (Ronay et al. 2024). Yet, dominant traits remain prevalent in human leadership despite such backlashes (Cheng et al. 2021; Kakkar and Sivanathan 2017).

It is attempting to argue that dominant leadership persists because of the effectiveness of dominance in maintaining cooperation and punishing defectors (Kessler and Cohrs 2008; Laustsen and Petersen 2015; Murray 2014; O'Gorman et al. 2009), especially in threatening situations where group cohesion is challenged. Evidence from experimental studies (Laustsen and Petersen 2017; Little et al. 2007) and large-scale surveys (Kakkar and Sivanathan 2017; Nettle and Saxe 2021; Sprong et al. 2019) indicates that dominance-based strategies are favoured in situations of extrinsic

danger and intra- or inter-group competition. These effects are mainly mediated by dominant leaders' perceived ability to enforce group norms and punish defectors when the group faces threats of zero-sum competition for resources (Hasty and Maner 2023; Nettle and Saxe 2021). Recent evidence also showed that individual differences, such as fast life-history strategies and personal experiences of resource scarcity, might predispose individuals to greater acceptance of dominant status-attaining strategies and leaders (Maner and Hasty 2022; Van Vugt and Smith 2019; Zhu et al. 2022). However, despite the threat-related biases in leadership perception and evaluation, people in different cultures more readily associate prestige-related traits, compared to dominance-related traits, with high status (Durkee et al. 2020). After accounting for personal experiences of threats and deprivation, prestigious leaders are still favoured over dominant leaders in implicit or explicit leadership preferences (Zhu et al. 2021, Zhu et al. 2022), even during wars and conflicts (Hasty and Maner 2023).

To bridge this theoretical gap, we argue that it is important to separate leader traits from leadership strategies. Dominant characteristics do not need to completely eclipse prestigious characteristics for leaders to perform the crucial functions of suppressing uncooperative behaviours. Rather, mixed leaders with balanced manifestations of dominant and prestigious traits can assume these policing roles just as well as purely dominant leaders in threatening contexts, whereas purely prestigious leaders become disadvantaged. This helps to maintain the variability of leadership strategies and explains the persistence of dominance over human evolution and societal development.

Additionally, few studies have distinguished between the types of threats or assessed multiple downstream outcomes. Threat-related experience conveys crucial information about the environment and is expected to shape cognitive development and situational responses (Frankenhuis et al. 2016). Evolutionary psychological theorists have distinguished between exogenous danger that is uncontrollable and unavoidable (i.e., harshness; Ellis et al. 2009) and endogenous competitive pressures that are sensitive to individual efforts and social contexts (resource scarcity and within-group competition; Sng et al. 2017; Yang et al. 2022) as two fundamental dimensions of environmental threats (Ellis et al. 2022). We argue that threat-contingent cognitive biases also affect how followers adapt to different leadership strategies (Bastardoz and Van Vugt 2019). In modern society, which is largely non-threatening, individuals tend to show a bias favouring prestige. However, such bias might be diminished in the face of salient situational threats, where dominant traits serve vital leadership functions such as protection against external threats and suppressing free-riding.

1.3 | Visual Attention Patterns Reflect Basic Leader Perception

To unpack the cognitive mechanism underlying the aforementioned effects of threat, the current research focuses on the visual processing of leader-related information obtained through the unobtrusive eye-tracking technique. The eye-tracking method probes into perceivers' visual attention processes that are not fully consciously controlled. Eye movements during reading and graphic visual tasks include saccades (quick and short movements lasting 20–50 ms) and fixation (when the eyes stay relatively still for approximately 150–300 ms). Visual information from stimuli is primarily obtained during fixation, which is largely driven by automatic processes constrained by cognitive resources and influenced by material difficulty (see Kliegl et al. 2006).

Recent years saw a growing number of eye-tracking studies investigating eye-movement patterns (particularly fixation duration) related to leader–follower dynamics and leader-following tendencies (e.g., Cheng et al. 2013; Maran et al. 2019; Liegl et al. 2024). For instance, in one study conducted by Cheng et al. (2013), participants looked longer at emergent leaders who adopted either a prestigious or dominant strategy in situations of hierarchy formation within task groups. The current research focused on eye dwell time (DT; defined as the sum of all fixation durations at areas of interest; Inhoff and Weger 2003) captured when participants read discrete trait words of leader characteristics and form impressions of leader candidates. DT is a commonly used index in eye-movement research and has been shown to be sensitive to visual and linguistic processes in reading (Inhoff and Weger 2003). We used participants' DT at dominance-related and prestige-related traits to reflect participants' relative attention to different aspects of leadership. Various combinations of these leader traits represent three leader types (dominant, prestigious and mixed).

Importantly, different eye-tracking studies with different task requirements would lead to different interpretations of DT. In eye-tracking research on reading tasks that involve semantic information processing (as in our studies), longer fixations typically reflect increased cognitive processing demands (see Rayner 2009; Kliegl et al. 2006). When individuals encounter stimuli or attributes inconsistent with their expectations or memory, their fixations also become longer. The effects of word frequency and predictability on fixation duration are well established. Contextual predictability also significantly affects fixation duration: Predictable words, those easily anticipated from prior context, are fixated on more briefly than unpredictable ones (e.g., Balota et al. 1985; Ehrlich and Rayner 1981). Likewise, during Chinese reading, fixation duration is influenced by visual complexity and semantic constraints (e.g., Yan et al. 2025). Such effects in reading should be distinguished from interpretations of fixation patterns in preference tasks or visual-searching tasks involving non-semantic stimuli, wherein longer DT indicates preference (e.g., Glaholt and Reingold 2009) or bottom-up cognitive factors like novelty and salience (e.g., Ernst et al. 2020).

Additionally, the visual attention pattern might shed light on the context-contingent cognitive bias that reflects evolved preferences of leadership under different ecological constraints. In modern environments that are safe and stable, dominant leadership faces strong backlashes (Kakkar et al. 2020). Thus, in non-threatening contexts, people should be more ready to process prestige-related information when forming impressions about leaders, causing dominant traits to elicit longer DT than prestigious traits. However, threatening situations favouring dominant traits typically weaken this effect (e.g., during wartime, intergroup competition or economic uncertainty; Kakkar and

Sivanathan 2017; Nettle and Saxe 2021; Sprong et al. 2019). Indeed, research has shown that emphasizing zero-sum competition for limited resources, wherein one party's gains necessarily entail losses for another (Wojciszke et al. 2009), drives individuals to favour dominant strategies (Andrews-Fearon and Davidai 2023). Such dominant strategies are seen to enhance leaders' ability to rein in unscrupulous competitive tactics and punish defectors (Hasty and Maner 2023). We hypothesized that, in the face of zero-sum competitive threats, dominant traits should become more context-compatible, leading to reduced DT. Similarly, in the face of extrinsic dangers insensitive to personal efforts and social interactions (e.g., natural disasters), individuals are forced to prioritize short-term survival over long-term fitness (Ellis et al. 2009). Prestigious traits, which confer long-term benefits in a safe environment, are incompatible with such dangerous conditions. This should, likewise, result in diminished readiness to process prestigious traits, eliciting longer DT than in non-threatening situations.

1.4 | Explicit Evaluations and Gaze-Cuing Reflect Leader Following

DT is one of the most widely used measures in eye-movement research and has been found to be highly sensitive to variations in individual differences, visual characteristics, linguistic features and social influences (Becker 2011; Inhoff and Weger 2003; Schilling et al. 1998). Fixation patterns of dominant/prestigious traits may not correspond one-on-one with tendencies to follow different leaders, who are evaluated holistically rather than by the sum of their individual traits. A comprehensive test of the ecological adaptive hypothesis, therefore, must simultaneously consider behavioural leader-following tendencies under various threat contexts.

The current research assessed two aspects of leader-following tendencies: explicit ratings and gaze-cuing effects. Both aspects are sensitive to leaders' characteristics and situational demands. Past research has shown that dominant leaders are rated more favourably and prestigious leaders less favourably when individuals face threats of danger or competition. For example, Bøggild and Laustsen (2016) found that increased zero-sum competition pressures from outgroups increased preferences for dominant-looking leaders. Using controlled and natural experiments, Laustsen and Petersen (2017) showed that increased favourability of dominance during social conflicts is mainly driven by the heuristic that dominant leaders are better at handling intergroup conflict situations than non-dominant leaders.

Leader following can also manifest in more implicit measures, such as gaze following. The gaze-following paradigm reflects a key component of leadership, which is the ability to effectively direct followers' attention (Cheng et al. 2023). Compared with explicit leadership evaluations, gaze-cuing measures based on response latency differences (quicker responses to stimuli in positions congruent with the leader's gazing direction) are less subject to deliberate control. They indicate the extent to which a leader is worthy of following. Past research has shown that dominant-looking leaders (created through masculinization manipulation of face photographs) elicit larger gaze-cuing effects than feminized leaders for both sexes (Jones et al. 2010; Ohlsen et al. 2013). Semantic leader-related information (e.g., occupational prestige presented in a resume) similarly enhanced the gaze-cuing effect of leaders who are associated with such information (Dalmaso et al. 2012, 2014).

Overall, we hypothesized that prestigious leaders should be favoured and capture followers' attention to a greater degree than dominant leaders in non-threatening situations (Henrich and Gil-White 2001; Liegl et al. 2024). Mixed leaders who manifest some prestige should also be favoured and attract the attention of followers, though not as much as prestigious leaders. By contrast, threatening situations involving danger or zero-sum competition should reduce or even reverse such trends. Specifically, dominant and mixed leaders are more likely to wield coercive power against defectors and enemies in threatening situations (Hasty and Maner 2023), reducing backlashes and earning them favourability from followers. The gaze direction of dominant or mixed leaders might also provide more adaptive information, increasing one's survival chance in threatening situations more than that of prestigious leaders (Jones et al. 2010), which should boost gaze-cuing effects.

1.5 | Overview of Current Research

The current research comprised two eye-tracking experiments seeking to test the ecological adaptive hypothesis outlined earlier. In both experiments, we recorded the eye movements of participants as they evaluated different types of leader candidates based on discrete characteristics associated with dominance- or prestige-based leadership strategies. Our tasks elicited participants' responses to one of three types of leaders: dominant (depicted by only dominant words), prestigious (only prestigious words) and mixed (an equal number of dominant and prestigious words). In Study 1, we asked participants to indicate their attitudes towards different leaders after seeing their characteristics. Study 2, by contrast, used a gaze-following paradigm to capture individuals' implicit tendencies to follow different types of leaders.

We hypothesized that individuals would exhibit shorter fixations for prestigious characteristics than dominant characteristics in non-threatening conditions, consistent with the backlash against dominance (H1). However, such a fixation pattern would change or even reverse when individuals are faced with contextual cues of extrinsic dangers or zero-sum competition (H2). Likewise, when exposed to non-threatening contexts, the evaluation ratings and gaze-cuing effects should be lower for dominant and mixed leaders than for prestigious leaders (H3). Such effects are expected to be eliminated or reversed in danger-focused or competition-focused contexts (H4). We also explored the context-contingent connections between eye fixation patterns and leader-following tendencies, although we did not have specific predictions (see Table 1 for a summary of all hypotheses).

All studies, measures, manipulations and data/participant exclusions are reported in the manuscript or the Supporting Information.

TABLE 1 | Summary of the hypotheses and findings.

Hypothesis	IVs	DVs	Condition/block	Prediction/Finding
H1	Trait Type: dominant, prestigious	DT (Studies 1 and 2)	Non-Zero-Sum Condition (Study 1) Neutral Block (Study 2)	**DT for dominant traits > DT for prestigious traits (supported)**
H2	Trait Type: dominant, prestigious	DT (Studies 1 and 2)	Zero-Sum Condition (Study 1) Competition-Focused Block and Danger-Focused Block (Study 2)	DT for dominant traits ≤ DT for prestigious traits (partially supported)
H3	Leader Type: dominant, prestigious, mixed	Evaluation ratings (Study 1) and gaze-cuing effects (Study 2)	Non-Zero-Sum Condition (Study 1) Neutral Block (Study 2)	**Ratings of dominant and mixed leaders < ratings of prestigious leaders (supported)** **Gaze cuing effect of dominant and mixed leaders < that of prestigious leaders (supported)**
H4	Leader Type: dominant, prestigious, mixed	Evaluation ratings (Study 1) and gaze-cuing effects (Study 2)	Zero-Sum Condition (Study 1) Competition-Focused Block and Danger-Focused Block (Study 2)	Ratings of dominant and mixed leaders ≥ ratings of prestigious leaders (partially supported) **Gaze cuing effect of dominant and mixed leaders ≥ that of prestigious leaders (supported)**

Note: Predictions supported by findings are boldfaced for clarity.
Abbreviations: DT = dwell time, DV = dependent variable, IV = independent variable.

2 | Study 1

Study 1 tested the idea that ecologically salient contexts influence the visual processing of leader characteristic information and leader evaluations. To begin, we focused on zero-sum competitive threats, which are seen as the evolutionary root of dominance (Cheng and Tracy 2014). Past research has shown that viewing status as a zero-sum resource prompts people to endorse dominant strategies (Andrews-Fearon and Davidai 2023). To test the ecological adaptive hypothesis, we created scenarios about zero-sum competition and, for the control condition, non-zero-sum scenarios wherein competition is not seen as a threat but as a long-term investment in personal-development goals.

Given the possibility that participants might construe the 'leader' at different levels, leaders' characteristics might exert different influences on followers depending on their relative position in the organizational hierarchy. Therefore, we asked participants to evaluate both direct supervisors and top decision-makers in the organization. As an instinctive heuristic, threat contexts are expected to exert similar influences on participants' responses to direct or top leaders. However, it is possible that evaluations of direct leaders are influenced by threat contexts to a greater extent, given that their characteristics have more immediate impacts on followers than those of top leaders.

2.1 | Method

All stimuli and instructions in both studies were originally presented in Chinese (the native language of the participants). Examples of experimental materials and codebook for measures (in English) are accessible on the OSF website at https://osf.io/3ukcm/?view_only=843d5fbb86e14db694f0f2f5b9b21983.

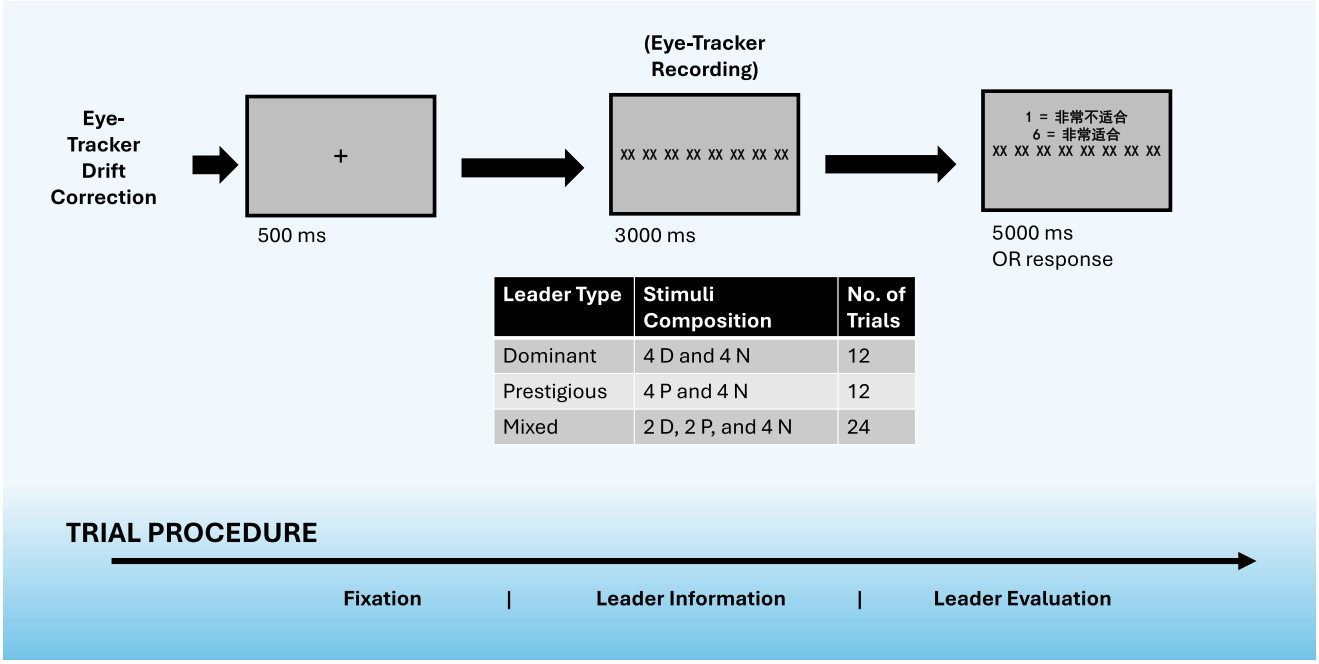
2.1.1 | Participants

Eighty-nine undergraduate students (27 males and 62 females, M_{age} = 20.93, SD_{age} = 2.42) who took psychological courses at [institution masked] participated in the study in exchange for extra credits. All participants were native speakers of Chinese and had normal or corrected-to-normal vision. They were randomly assigned to a Zero-Sum Condition (n = 44) and a Non-Zero-Sum Condition (n = 45).

2.1.2 | Manipulating Threat Contexts: News Story Task

Under the disguise of a language processing study, participants were asked to read and answer questions about different 'news articles' adapted from real news articles. Participants in both conditions first read a story about the recent Asian Para Games in Hangzhou, China, divided into four paragraphs (each presented on one page). The practice story was presented for a total of 120 s (30 s for each paragraph). Comprehension questions followed different paragraphs are served to ensure participants' engagement in the task. This practice article serves to familiarize participants with the eye-tracking procedure and minimize suspicion about the study's true purpose. During the practice task, no eye-tracking data was analysed.

Next, participants were asked to read another 'news article' about societal competition. The articles contained largely identical background information but differed in their interpretation of



Leader Type	Stimuli Composition	No. of Trials
Dominant	4 D and 4 N	12
Prestigious	4 P and 4 N	12
Mixed	2 D, 2 P, and 4 N	24

FIGURE 1 | Study 1: Trial procedure and the number of leader characteristics stimuli (D = dominant traits, N = neutral fillers, P = prestigious traits) and different types of trials in the Leader Evaluation Task.

the nature of vocational and educational competition. Specifically, the zero-sum article emphasized that societal resources are limited and advocated ruthless strategies to defeat others. By contrast, the non-zero-sum article emphasized orderly societal competition based on people's abilities and merits and encouraged long-term efforts of self-improvement as the winning strategy. Both articles were 800–900 Chinese characters in length and were divided into eight paragraphs with the same presenting time for each paragraph as the practice article.

2.1.3 | Manipulation Check

After completing the News Story Task, participants were asked to answer a series of manipulation check items presented on an online questionnaire. Six items adapted from the Belief in a Zero-Sum Game (BZSG) scale (Wojciszke et al. 2009) assessed zero-sum competitive contexts (e.g., 'In societal competition, everyone who is competing for the same goal thinks the most about how to win against others at all cost.'; Cronbach's α was 0.80). Six items adapted from the Personal Development Competitive Attitude Scale (Ryckman et al. 1996) assessed non-zero-sum competitive contexts, which conceptualize competition as a form of contest based on personal effort and investment in personal development (e.g., 'In the current society, a person's income growth is mainly determined by the person's value to the society compared with his peers.'; Cronbach's α was 0.75). Specifically, participants were asked to indicate how much they think the article conveyed the ideas of each statement from 1 (*negligible*) to 6 (*very strong*).

2.1.4 | Leader Evaluation Task

The leader evaluation task sought to examine the relative visual attention directed at dominant versus prestigious traits during the evaluation of leader candidates. To avoid overt connection to the threat context priming, participants were told that this was a separate reading task that involved social judgements. They were asked to silently read leader-related information and form impressions of different leaders in workplace settings. In two blocks, participants evaluated candidates for direct supervisors (Direct-Leader Block) or candidates for top decision-makers of the organization (Top-Leader Block). Other aspects were identical. In each trial, participants were presented with eight discrete words describing the characteristics of a leader candidate. These words appeared on the same screen (Figure 1, second screen), presented on a single line, with four target words in the centre, flanked by four filler words. Different target words represented different leadership strategies: we selected 12 words representing dominant leadership (e.g., 'strict' and 'tough') and 12 words representing prestigious leadership (e.g., 'gentle' and 'respectable'). All target and filler words comprised two Chinese characters, each subtending 0.7 degrees of visual angle on the screen. They were adapted from existing materials related to leadership qualities (Durkee et al. 2020) and matched in terms of stroke number and word frequency. The list of leader characteristic words, along with the material validation process, is presented in the Supporting Information.

Each block started with four practice trials (which were not analysed) to familiarize participants with the operation. Participants rated, in random sequence, six dominant leaders (each characterized by four randomly selected dominant words), six prestigious leaders (each characterized by four randomly selected prestigious words) and 12 mixed leaders (each characterized by two dominant words and two prestigious words). The specific combinations differed across trials and participants but were counterbalanced, such that in each block, participants would see the exact dominant or prestigious target words for an equal number of times. The presenting

sequence of the two blocks was also counterbalanced between participants.

Each trial started with an eye-tracker drift correction procedure, in which the participant initiated the trial by looking at a centre fixation point. The duration of this procedure varied across individuals, thereby minimizing anticipation effects. Then, a fixation point appeared at the centre of the screen (where target words would subsequently appear). The eight characteristics first appeared without the rating scale, during which participants' eye movements were recorded. After 3000 ms, a 6-point rating scale appeared above the eight words. The participants were instructed to press the numbers key '1'–'6' (1 = *least suitable*, 6 = *most suitable*) to indicate the degree to which they would like such a leader to assume the direct/top leadership position. If the participant did not respond within 5000 ms, this trial would be recorded as 'no response'. (Figure 1)

2.1.5 | Procedure and Eye-Movement Recording

The participants were tested individually in a small chamber and informed that this experiment consisted of several independent tasks unrelated to one another. They were seated at a distance of 65 cm from a BenQ ZOWIE XL2546K monitor (resolution: 1920 × 1080 pixels; frame rate: 240 Hz) with their heads positioned on a chin-and-forehead rest. All recordings and calibrations were performed monocularly based on the participants' right eyes, and viewing was binocular.

The experiment consisted of four parts. The first part was the News Story Task, which was followed by a manipulation check. Then, the participants completed the Leader Evaluation Task. These tasks were programmed using the SR Research Experiment Builder software (2020; Version 2.4.193) and executed on a computer equipped with an EyeLink Desktop system. Before each experimental task, the participants' gaze positions were calibrated with a 5-point grid (maximum errors < 0.5°). The participants' eye movements were recorded with an EyeLink Desktop system running at a sampling rate of 1000 Hz with accuracy down to 0.15° of visual angle (EyeLink CL Version 1.4, SR Research, Ottawa, Ontario). In the Leader Evaluation Task, tracking accuracy was checked before each trial.

Finally, participants were asked to input demographic information (gender and age) and complete a few additional measures that assess their world beliefs in an online questionnaire (these additional measures were not analysed in this research).

2.1.6 | Data Analysis

Data screening and analysis were performed using IBM SPSS 24 and the R 4.3.1 software package. Mixed analyses of variance (ANOVAs) examined the between-subjects effects of experimental condition and block sequence on manipulation-check ratings and DT in the Leader Evaluation Task. Significant interactions were probed using pairwise comparisons in the General Linear Model (GLM) with Bonferroni correction for multiple comparisons.

2.2 | Results

Table S1.1 in the Supporting Information reports the correlations among variables in two conditions.

2.2.1 | Data Screening

Among a total of 4272 non-practice trials, 30 (0.7%) were removed due to tracker errors, participants' blinks or body movements during reading. Trials with response latency shorter than 100 ms or three SDs longer than the mean of the same type of trials in the same block were also dropped, as these reflect atypical reading patterns (Hao et al. 2024). This resulted in a loss of 186 trials (4.4%). These data exclusion practices are commonly adopted in similar eye-tracking studies with comparable exclusion rates. The number of removed trials was roughly even between the two conditions.

2.2.2 | Manipulation Check

Analyses of the manipulation-check items (reported in detail in the Supporting Information; full statistics are reported in Tables S1.2 and S1.3) showed that the experimental manipulations elicited distinct perceptions of competitive contexts in intended ways.

2.2.3 | Eye Fixation Pattern

We first examined DT at different types of leader characteristics words in different trials of the Leader Evaluation Task. DT refers to the total time (in ms) spent on the current rectangle-shaped interest area (IA) surrounding a leader characteristic word (238 × 213 pixels), regardless of the number of fixations. For each block, we calculated the average DT for four trait types: (i) dominant words in dominant trials, (ii) prestigious words in prestigious trials, (iii) dominant words in mixed trials and (iv) prestigious words in mixed trials.

A 4 (Trait Type) × 2 (Block: Direct-Leader, Top-Leader) × 2 (Condition: Zero-Sum, Non-Zero-Sum) × 2 (Sequence: Direct-Leader-First, Top-Leader-First) mixed ANOVA on DT, with Trait Type and Block as within-subjects factors and Condition and Sequence as between-subjects factors, revealed a significant main effect of Trait Type, $F(3, 252) = 60.74$, $p < 0.001$, $\eta^2_p = 0.42$, a significant Trait Type × Condition interaction, $F(3, 252) = 24.15$, $p < 0.001$, $\eta^2_p = 0.22$, a Trait Type × Sequence interaction on DT, $F(3, 252) = 2.67$, $p = 0.048$, $\eta^2_p = 0.03$, and a significant Block × Sequence interaction, $F(1, 84) = 9.36$, $p = 0.003$, $\eta^2_p = 0.10$. All other main effects or interactions were not significant (see Table S1.4 in the Supporting Information). Pairwise comparisons across different trait types with Bonferroni corrections for multiple comparisons showed that dominant traits in dominant and mixed trials consistently elicited longer DT than prestigious traits in prestigious and mixed trials in the Non-Zero-Sum Condition. Nevertheless, in the Zero-Sum Condition, dominant traits in dominant trials still attracted significantly longer DT than prestigious traits in prestigious or mixed trials, but DT for dominant traits in mixed trials became shorter and not significantly different from those for prestigious traits (see

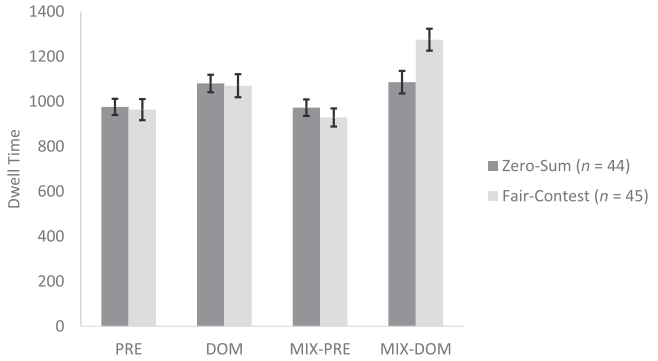


FIGURE 2 | Study 1: Dwell time for different leader traits in the Direct Leader Block. DOM = dominant traits in dominant trials, MIX-DOM = dominant traits in mixed trials, MIX-PRE = prestigious traits in mixed trials, PRE = prestigious traits in prestigious trials. Error bars represent standard errors.

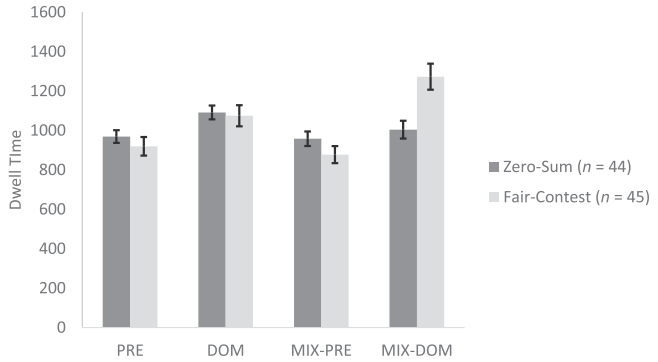


FIGURE 3 | Study 1: Dwell time for different leader traits in the Top Leader Block. DOM = dominant traits in dominant trials, MIX-DOM = dominant traits in mixed trials, MIX-PRE = prestigious traits in mixed trials, PRE = prestigious traits in prestigious trials. Error bars represent standard errors.

Figures 2 and 3). The full statistics are reported in Table S1.5 in the Supporting Information.

In the meantime, we decomposed the interactions involving Sequence using pairwise *t*-tests comparing DT for different IAs between the Direct-Leader and Top-Leader Blocks (Table S1.6 in the Supporting Information). We found that when participants evaluated direct leaders first, their DT at prestigious words in prestigious trials was significantly longer in the Direct-Leader Block (M = 1019.19 ms, SD = 239.33 ms) than in the Top-Leader Block (M = 916.47 ms, SD = 277.62 ms). Similarly, their DT at prestigious words in mixed trials was significantly longer in the Direct-Leader Block (M = 1018.47 ms, SD = 258.25 ms) than in the Top-Leader Block (M = 932.64 ms, SD = 260.00 ms). However, these effects disappeared when the block sequence was reversed.

2.2.4 | Leader Evaluation Ratings

A 3 (Leader Type) × 2 (Block) × 2 (Condition) × 2 (Sequence) mixed ANOVA revealed a significant main effect of Leader Type, $F(2, 170) = 70.03$, $p < 0.001$, $\eta^2_p = 0.45$, a significant main effect

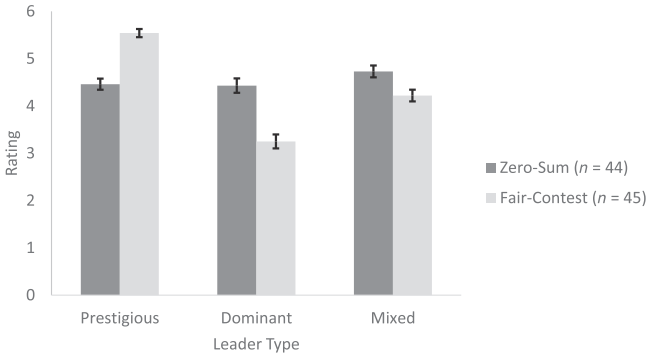


FIGURE 4 | Study 1: Leader evaluation ratings for different types of leaders in the Direct Leader Block. Error bars represent standard errors.

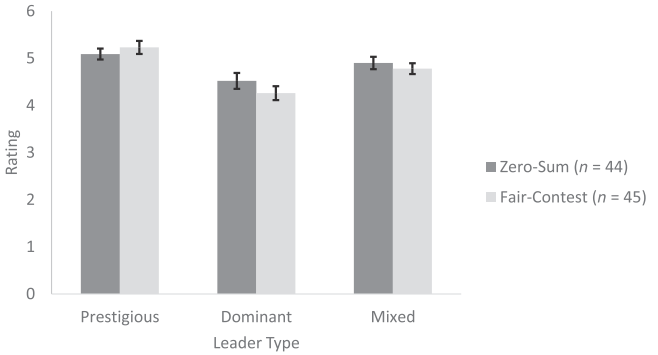


FIGURE 5 | Study 1: Leader evaluation ratings for different types of leaders in the Top Leader Block. Error bars represent standard errors.

of Block, $F(1, 85) = 45.50$, $p < 0.001$, $\eta^2_p = 0.35$, a significant interaction between Leader Type and Block, $F(2, 170) = 5.52$, $p = 0.005$, $\eta^2_p = 0.06$, a significant interaction between Leader Type and Condition, $F(2, 170) = 34.51$, $p < 0.001$, $\eta^2_p = 0.29$, and a significant three-way interaction among Leader Type, Block and Condition, $F(2, 170) = 33.43$, $p < 0.001$, $\eta^2_p = 0.28$. Other effects were not significant (see Figures 4 and 5 and Table S1.8 in the Supporting Information).

Decomposition of this three-way interaction showed that, in the Direct-Leader Block, participants in the Zero-Sum Condition did not rate different types of leaders significantly differently, $F(2, 86) = 2.68$, $p = 0.075$, $\eta^2_p = 0.06$. However, the opposite was true for participants in the Non-Zero-Sum Condition, $F(2, 88) = 200.89$, $p < 0.001$, $\eta^2_p = 0.82$. Pairwise comparisons (Table S1.9 in the Supporting Information) showed that dominant leaders were rated significantly lower than prestigious leaders and mixed leaders. In contrast, prestigious leaders were rated significantly higher than mixed leaders. In the Top-Leader Block, participants in both the Zero-Sum Condition ($F(2, 86) = 7.19$, $p = 0.001$, $\eta^2_p = 0.14$) and the Non-Zero-Sum Condition ($F(2, 88) = 21.13$, $p < 0.001$, $\eta^2_p = 0.32$) rated different types of leaders significantly differently. Specifically, for participants in the Zero-Sum Condition, dominant leaders were rated significantly lower than prestigious leaders and mixed leaders. However, prestigious leaders and mixed leaders did not differ in their evaluative ratings. In the Non-Zero-Sum Condition, we found the same pattern for the ratings of top leaders as that for the ratings of direct leaders.

2.2.5 | Conditional Effects of Eye Fixation Pattern on Leader Evaluation

For different participants, the mean DT for different traits can vary greatly, such that the absolute value of DT does not indicate relative readiness to process dominant or prestigious traits. To assess visual processing priority, we calculated a dwell time ratio (DTR), dividing DT for prestigious traits by DT for dominant traits. A DTR higher than 1 indicates a longer DT for prestigious than dominant traits (indicating readiness to process dominance-related information). The results of DTR (described in detail in the Supporting Information; see Table S1.7) allow one to more precisely gauge the magnitude of the prestige bias effect and threat-contingent effect.

To explore the relationship between eye fixation pattern and leader evaluation, we conducted moderation analyses using Model 1 of the PROCESS macro in SPSS (Hayes 2018), testing six models (three for the ratings of dominant, prestigious and mixed leaders in the Direct-Leader Block, respectively, and three in the Top-Leader Block). We focused on the interaction between the experimental condition and the DTR of the corresponding block. Although the interaction for all models in the Direct-Leader Block and ratings of dominant leaders in the Top-Leader Block was not significant, we found significant positive interactions between experimental condition and DTR in the Top-Leader Block on the ratings of prestigious leaders and mixed leaders. Specifically, when faced with zero-sum competitive threats, relatively faster processing of dominant traits compared to prestigious traits predicted lower ratings of prestigious and mixed candidates as top leaders. The detailed statistics for these results are reported in the Supporting Information.

2.3 | Discussion

Using characteristic words to anchor visual attention, our task first examined followers' visual processing of leadership-related information. The results supported the hypothesized gaze bias—prestigious words had shorter DT, indicating that participants normally expect prestigious traits. Additionally, consistent with H2, the aforementioned gaze bias diminished when participants faced contextual cues of zero-sum competition, leading to a reduced looking time at dominant words. The results of DT supported the expected visual attention pattern and the threat-contingent effects. In addition to the hypothesized effects, we also found significant interactions involving block sequence. This could simply be attributed to material (un)familiarity. Participants typically spent longer fixating on the leader traits in the first block they encountered, although this did not result in significant differences in all cases.

The results of leader evaluation showed that participants in the Non-Zero-Sum Condition rated prestigious candidates the highest and dominant candidates the lowest, with mixed leaders in the middle, consistent with H3 and the nuanced prediction regarding mixed leaders. Such differences narrowed considerably for participants in the Zero-Sum Condition, especially when rating them as direct leaders. Hence, H4 is also partially supported. This pattern is largely consistent with the ecological adaptive hypothesis, as dominant and mixed leaders served important roles in maintaining order and punishing rule-breakers in the face of intragroup competition (Kakkar and Sivanathan 2017).

Contextual manipulations appeared to have a greater impact on the evaluation of direct leaders than top leaders. This might be because direct and top leaders represent different construal levels in cognitive processing (Trope and Liberman 2010). Rating direct leaders prolonged DT for leader characteristics (especially in the first block of the task) compared to rating top leaders. This likely involved an experience-based, low-level construal of leaders, which is more susceptible to the influences of low-level contextual manipulations. By contrast, evaluations of top leaders might rely more on abstract knowledge about organizational principles and leadership strategies, thus being less susceptible to the influence of immediate contexts.

Finally, the exploratory moderation analyses provided preliminary evidence that specific patterns of visual fixation, more specifically diminished prestige-processing advantage indicated by higher DTR, indeed predicted lower ratings of leaders with prestigious traits. However, such effects were limited to the evaluation of top leaders under zero-sum competitive situations. This supports the view that followers' leadership perceptions are motivated by their need to deal with situational challenges. Characteristics of top leaders (who likely have some impact on local environments through their power and influence) appear to matter more in zero-sum competitive environments, such that visual processing patterns inform leader evaluations more strongly.

3 | Study 2

Study 2 (pre-registered on the OSF website at https://osf.io/fd3je/?view_only=bf6daef99ef54a3b9751d0f3e4253b23) delved deeper into the phenomenon of context-contingent processing bias of leader-related information and leader-following tendencies. To minimize the potential confounding effects of inter-individual variations, Study 2 adopted a within-subjects design. Additionally, we employed the gaze-cuing paradigm to further tap into leader-following responses. The gaze-cuing task allowed us to compare the gaze-cuing effects (i.e., faster responses to stimuli appearing at the location cued by the leader's gaze than at the opposite location) of dominant, prestigious and mixed leaders. We hypothesized that the gaze-cuing effects, like explicit leadership evaluation in Study 1, would be influenced by an interaction between leader types and threat contexts in ecologically adaptive ways. Study 2 extended the threat contexts to both danger-focused and competition-focused threats (Duckitt et al. 2002; Ellis et al. 2022), aiming to demonstrate that the findings of Study 1 were not specific to one kind of ecological threat (zero-sum competition). We predicted that danger-focused threats would enact similar leadership heuristics, resulting in qualitatively similar responses in leader perception and leadership evaluative tendencies as competition-focused threats. However, as danger-focused threats (e.g., fragile environments and societal instability) are relatively insensitive to individuals' personal efforts and choices, their effects might be weaker than competition-focused threats.

3.1 | Method

Examples of experimental materials and codebook for measures (in English) are accessible on the OSF website at https://osf.io/3ukcm/?view_only=843d5fbb86e14db694f0f2f5b9b21983.

3.1.1 | Participants

Sixty-one undergraduate students (17 males and 44 females, ages ranging from 18 to 27, $M = 19.95$, SD = 1.87) who took psychological courses at the [institution masked] participated in the study in exchange for extra credits. All participants were native speakers of Chinese and had normal or corrected-to-normal vision. Three participants were excluded due to incorrect responses in more than 10% of the trials of the Leader Gaze-Following Task.

3.1.2 | Manipulating Threat Contexts

The experiment comprised a computerized task programmed using the SR Research Experiment Builder software (2020) and an online questionnaire. The former comprised three parts, each beginning with a situational priming, in which participants read a scenario about societal challenges that elicit a danger-focused, competition-focused or neutral context. They were asked to imagine living in the society depicted in the scenario text. In the Neutral Block, participants read about a city preparing to host an international sports event. In the Danger-Focused Block, participants read about a society where people constantly face survival challenges such as gang violence, immigration crisis and political instability. In the Competition-Focused Block, participants read about a society where people constantly face intense zero-sum-game-like competition that undermines fairness and social trust. Participants were randomly assigned to three block sequences starting with the Neutral, Danger-Focused or Competition-Focused Block, respectively (ns = 20, 18 and 20). The blocks were arranged with a Latin square design and, thus, had about the same chance of appearing in the first, second or third place.

Participants subsequently responded to 10 manipulation check questions (five regarding danger-focused situational threats and five regarding competition-focused threats), which were adapted from the 'Dangerous and Threatening Social Worldview' scale (e.g., 'any day now chaos and anarchy could erupt around us') and the 'Competitive Jungle Social Worldview' scale (e.g., 'winning is not the first thing; it's the only thing'; Duckitt et al. 2002). They indicated on a 6-point Likert scale how much the statements reflect the environments in the news stories. The α coefficients for danger-focused situational threats were 0.97, 0.93 and 0.92 for the neutral, danger-focused and competition-focused blocks, respectively. The α coefficients for competition-focused situational threats were 90, 0.75 and 0.71 for the neutral, danger-focused and competition-focused blocks, respectively.

3.1.3 | Main Task: Leader Gaze Following Task

Following the scenario text screen, participants were given as much time as needed to memorize three target words (related to the priming theme of the block) and three non-target words and their corresponding response keys. Half of the participants were instructed to press the number keys 6 and 7 for targets and non-targets, respectively, whereas the other half of the participants were given the reversed responding keys. All targets and non-targets were three-character Chinese words matched in the number of strokes and word frequency. All Chinese characters were of the same font size, subtending 0.7 degrees of visual angle.

In the subsequent practice phase, participants responded to 12 practice trials, which were not analysed. Each trial began with a drift correction (like in Study 1), followed by a centrally placed fixation (500 ms) and a blank screen (5300 ms). These, in turn, were followed by a target word or non-target word positioned either to the left or the right of the screen centre with equal probability. Participants must respond as soon as possible when the stimulus appears by pressing the corresponding keys for the targets and non-targets. The stimulus remained visible until a response was provided or 3000 ms elapsed, whichever came first (Figure 6).

The testing phase used a similar trial procedure as the practice phase, except that a display of leader-related information followed the fixation. Specifically, a direct-gazing leader's face, measuring 19.4° × 26.4°, was presented at the upper centre of the screen, with four trait words characterizing the leader displayed beneath it. These stimuli were presented for 5000 ms based on feedback about the approximate time needed to process all the trait words from pilot testing. Like in Study 1, participants were instructed to silently read leader-related information and form impressions of different leaders, which was purported to facilitate subsequent responses. Additionally, the gaze cues on the face were designed to offer no clue to the onset position of ensuing stimuli. Each trial in a block presented a different male leader face in the upper centre of the screen, accompanied by a random set of trait words beneath it. Faces were selected from an openly accessible face database (Chicago Face Database [CFD]; Ma et al. 2015) and edited to look older using the Adobe Photoshop neural filter. Since leaders are generally older (Vaughan-Johnston et al. 2021), this ageing manipulation improved the perceived credibility of the leader faces without altering the other dimensions, such as masculinity. The leader characteristics were the same ones used in Study 1: dominant leaders were characterized by four dominant words, prestigious leaders were characterized by four prestigious words and mixed leaders were characterized by two dominant words and two prestigious words. Specific leader faces were not associated with a certain type of leader. Like in Study 1, participants were instructed to pay attention to these characteristic words and form impressions of the leader (but not required to make evaluation ratings). The leader-related information display was followed by a transient gaze cue display screen, wherein the leader's eyes averted to the right or the left for 300 ms. Subsequently, participants made the same responses as in the practice trials. Each testing block comprised 36 trials presented in a random order, for a total of 108 trials.

3.1.4 | Procedure and Eye-Movement Recording

Upon arrival at the laboratory, participants first read the information sheet containing information about the study and their rights as participants. The experiment began after they signed the consent form. Participants were tested individually in a

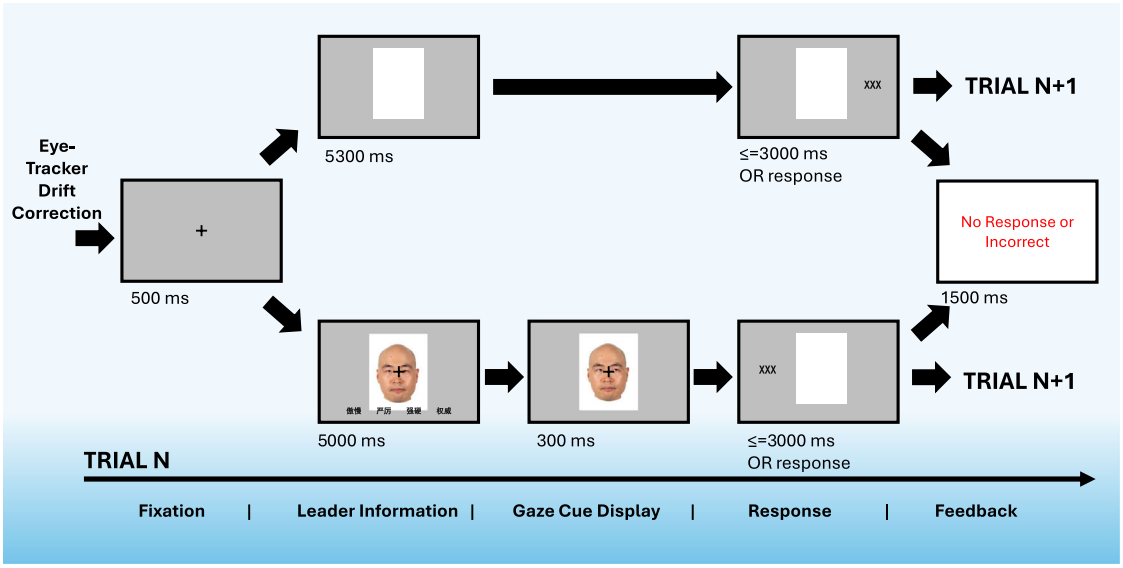


FIGURE 6 | Study 2: Trial procedure for the Leader Gaze Following Task.

small chamber. Participants' eye movements were recorded using the same EyeLink Desktop system as in Study 1, with the same experimental environment settings and the same tracker accuracy calibration procedure. All recordings and calibrations were performed monocularly based on the participants' right eyes, and viewing was binocular.

After completing each block of the main task, participants responded to the same set of 10 manipulation-check questions indicating perceived situational threats in an online questionnaire. Following the third manipulation check, participants were asked to complete several measures of adverse experiences in the online questionnaire. Participants also provided the following personal information: gender, age and subjective social status in terms of wealth, education and occupational reputation (the α coefficient was 0.87). In accordance with the pre-registered plan, we explored the effects of the factors of adverse experiences on dependent measures. Details of the measures and additional results of pre-registered exploratory analyses are reported in the Supporting Information. Finally, participants were debriefed and thanked for participating.

3.2 | Results

Tables S2.1–S2.3 in the Supporting Information report the correlations across main variables in the Neutral, Danger-Focused and Competition-Focused Blocks.

Some analyses deviated from the pre-registered plan, including repeated-measures ANOVAs on the manipulation check scores, a 4 (Trait type) × 3 (Block) × 3 (Sequence) mixed ANOVA on DT (ms) and a 3 (Block) × 3 (Leader Type) × 3 (Sequence) mixed ANOVA on the gaze-cuing effects.

3.2.1 | Data Screening

In accordance with pre-registered data exclusion criteria, 170 trials (0.52% of 32,940 non-practice trials) were removed due to tracker errors, participants' blinks or movements, or extremely short (< 100 ms) or extremely long RTs (three SDs longer than the average RT).

3.2.2 | Manipulation Check

Analyses of the manipulation check items (reported in detail in Supporting Information) showed that our manipulations managed to elicit distinct perceptions of threat contexts in intended ways.

3.2.3 | Eye Fixation Pattern

Like in Study 1, we created rectangle-shaped IAs surrounding each leader characteristic word (238 × 213 pixels) in the leader-related information phase of each trial. For each block, we calculated DT for four types of IAs and DTR as in Study 1.

We first conducted a 4 (Trait Type) × 3 (Block) × 3 (Sequence) mixed ANOVA on DT (ms). Trait Type and Block were within-subjects factors, whereas Sequence was a between-subjects factor. This revealed a significant main effect of Trait Type, $F(3, 324) = 7.16$, $p < 0.001$, $\eta^2_p = 0.12$, and a significant Trait Type × Block interaction, $F(6, 324) = 3.15$, $p = 0.005$, $\eta^2_p = 0.06$. All other effects were not significant (see Table S2.4 of the Supporting Information). Decomposition of the Trait Type × Block interaction revealed that DT differed significantly across different types of traits in the Neutral Block, $F(3, 171) = 11.21$, $p < 0.001$, $\eta^2_p = 0.16$, and the Danger-Focused Block, $F(3, 168) = 4.46$, $p = 0.005$, $\eta^2_p = 0.07$, but not the Competition-Focused Block, $F(3, 171) = 0.43$, $p = 0.732$, $\eta^2_p < 0.01$. Pairwise comparisons with Bonferroni adjustment showed that, in the Neutral Block, DT for dominant traits in dominant trials was longer than that of prestigious traits in mixed trials. DT for dominant traits in mixed trials was longer than that for prestigious traits in prestigious and mixed trials. In the Danger-Focused Block, DT for dominant traits in mixed trials was longer than that for prestigious traits in mixed

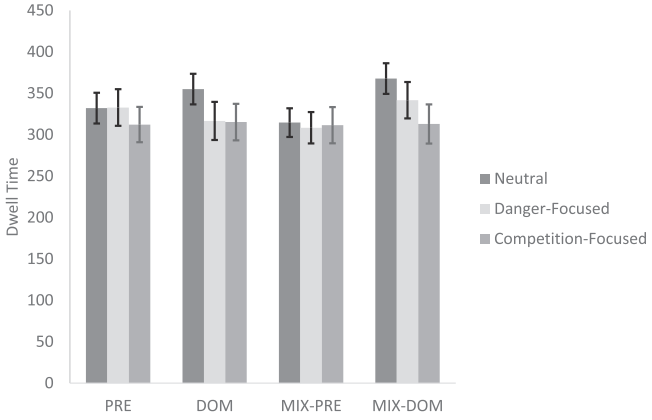


FIGURE 7 | Study 2: Dwell time for different leader traits across different blocks ($N = 58$). Error bars represent standard errors.

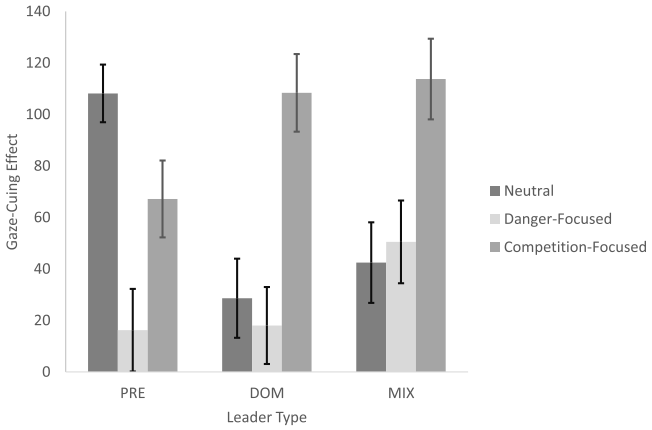


FIGURE 8 | Study 2: Gaze-cuing effects for different types of leaders across different blocks ($N = 58$). Error bars represent standard errors.

trials. These effects were eliminated in the Competition-Focused Block (see Figure 7 and Table S2.5 in the Supporting Information).

3.2.4 | Gaze-Cuing Effects

A 3 (Block) × 3 (Leader Type: dominant, prestigious and mixed) × 3 (Sequence) mixed ANOVA on the gaze-cuing effects of different leaders revealed a significant main effect of Block, $F(2, 216) = 13.92$, $p < 0.001$, $\eta^2_p = 0.21$, which was qualified by a significant interaction between Block and Leader Type, $F(4, 216) = 5.53$, $p < 0.001$, $\eta^2_p = 0.09$. The other effects were not significant (see Figure 8 and Table S2.6 in the Supporting Information).

We decomposed the Block × Leader Type interaction with three repeated-measures ANOVAs conducted within each of the three blocks. For the Neutral Block, gaze-cuing effects differed significantly across different leader types, $F(2, 116) = 8.58$, $p < 0.001$, $\eta^2_p = 0.13$. Pairwise comparisons with Bonferroni adjustment showed that prestigious leaders elicited greater gaze-cuing effects than dominant leaders, $p = 0.001$, Cohen's $d = 3.75$, 95% CI [26.40, 127.75], and mixed leaders, $p = 0.001$, Cohen's $d = 3.89$, 95% CI [24.89, 111.09]. In contrast, dominant leaders did not differ from mixed leaders, $p > 0.999$, Cohen's $d = 0.40$, 95% CI [−64.93, 46.77]. For the Danger-Focused ($F(2, 120) = 1.81$, $p = 0.168$, $\eta^2_p = 0.03$) and Competition-Focused ($F(2, 120) = 1.87$, $p = 0.158$, $\eta^2_p = 0.03$) Blocks, gaze-cuing effects for different types of leaders did not differ significantly.

3.2.5 | Conditional Effects of Eye Fixation Pattern on Gaze-Cuing

To explore the relationship between eye fixation patterns and gaze-cuing effects, we examined the correlations between visual attention variables (DT and DTR) and gaze-cuing effects in different blocks (full correlation tables are reported in the Supporting Information, Tables S2.1–S2.3). Except for one case where DT for dominant traits in mixed trials was negatively correlated with gaze-following of mixed leaders ($r = 0.28$, $p = 0.029$), DT of various types of leader traits did not correlate with gaze-cuing effects. In the Neutral and Danger-Focused Blocks, we found that higher DTR were negatively correlated with gaze-cuing of prestigious leaders (rs = −0.27, −0.47, ps = 0.036, < 0.001), but not that of dominant leaders (rs = −0.08, −0.16, ps = 0.540, 0.214) or mixed leaders (rs = 0.04, 0.21, ps = 0.750, 0.105). In the Competition-Focused Block, the correlation between higher DTR and gaze-cuing of prestigious leaders was not significant ($r = 0.13$, $p = 0.329$). In contrast, higher DTR was correlated with stronger gaze-cuing of dominant leaders ($r = 0.31$, $p = 0.015$) and mixed leaders ($r = 0.45$, $p = 0.001$).

3.3 | Discussion

Like in Study 1, we found shorter DT for prestigious traits than for dominant traits in the Neutral Block, which is consistent with H1. This effect was largely eliminated in the Competition-Focused Block but not entirely so in the Danger-Focused Block. This pattern is expected, given that danger-focused threat contexts are less sensitive to the group regulatory functions of leader traits compared to competition-focused ones (e.g., the effectiveness of dominant traits in maintaining group cohesion; Kakkar and Sivanathan 2017). Regarding gaze-cuing effects, we found that the gaze of prestigious leaders was followed the most in the non-threatening situation, supporting H3. The gaze-cuing effects of dominant and mixed leaders increased after zero-sum competition cues but not after extrinsic danger cues. Nevertheless, the gaze-following of prestigious leaders dropped considerably after extrinsic danger cues. Thus, both types of threatening situations led to reduced prestige bias in gaze cuing (consistent with H4), albeit in different ways.

Lastly, the correlational patterns depicted a complex relationship between visual attention patterns and downstream behavioural outcomes. We found little evidence of straightforward effects of longer or shorter gaze duration, and these effects are contingent on threat contexts. However, higher DTR (reflecting diminished prestige-processing advantage) correlated with lower gaze-cuing of prestigious leaders in non-threatening or dangerous situations but with stronger gaze-cuing of mixed and dominant leaders in competition-focused situations. Note also that the average DTR differed across different blocks. It was the highest in the Competition-Focused Block, followed by the Danger-Focused Block, and the lowest in the Neutral Block (detailed results in the Supporting Information). Together with the moderation findings in Study 1, these findings reflect nuanced differences in

the underlying cognitive processes between the two measures of leader-following tendencies and how they might be informed by visual attention patterns (further discussions below).

Beyond the results discussed here, we also conducted pre-registered exploratory analyses on the effects of self-reported environmental adversity on fixation patterns (DTR) and gaze-cuing effects across the three blocks. These additional measures of adversity and results are reported in the Supporting Information (Tables S2.7 and S2.8). Although self-reported adversity did not predict DTR, it predicted gaze-cuing in ways consistent with the ecological adaptive perspective.

4 | General Discussion

Visual attention provides crucial insights into the cognitive processes underlying leader-following. The current research combines the eye-tracking technique with established experimental paradigms (e.g., the gaze-cuing paradigm) to investigate how ecologically salient contexts influence individuals' visual processing of leader characteristics and behavioural response tendencies to different types of leadership. We consistently found that participants spent less time gazing at prestigious words than at dominant words in non-threat situations (the Non-Zero-Sum Condition in Study 1 and the Neutral Block in Study 2). Moreover, such prestige-processing advantages diminished when participants were exposed to threatening contexts, particularly those related to zero-sum competition. This visual attention pattern deserves further explication.

Direct perception of leaders' behaviours (e.g., eye contact) or physical features (e.g., facial masculinity) provides high ecological validity but risks introducing unwanted confounding factors (e.g., facial attractiveness). The discrete-traits approach adopted in the current research allows greater precision and flexibility in the manipulation of perceived leadership strategies (Cheng et al. 2010, 2021; Durkee et al. 2020) and offers new insights into the visual processing of leader-related information. Previous research focusing on leader faces or social scenes of leader–follower exchanges typically suggested that longer gazes indicate higher leadership evaluations and preferences (for prestigious or charismatic leaders; Maran et al. 2019). This is consistent with the ethology of prestige, as followers want to gain informational benefits by closely following prestigious leaders and attending to stimuli that these leaders attend to (Henrich and Gil-White 2001). However, that does not apply to semantic information processing, for which a longer fixation generally indicates a more effortful cognitive process, indicating enhanced semantic or memory processing (Hollingworth et al. 2001). Hence, our findings likely reflect an 'expectation effect', wherein visual objects not matching expectations elicit a longer fixation. In the current study, dominant characteristics were unexpected in the Non-Zero-Sum Condition, given that modern society is structured in ways that facilitate non-zero-sum forms of prestige competition rather than a zero-sum struggle for dominance. However, this does not mean that individuals' visual attention is always more tuned in to prestigious traits than dominant traits. Our findings showed that situational priming of threat contexts activates different visual attention patterns that diminish the prestige-processing advantage.

The pattern of leader ratings in Study 1 and gaze-cuing effects in Study 2 buttressed the ecological adaptive hypothesis, which postulates that evolved heuristics prompt people to favour dominant traits in threatening situations because dominant strategies are needed to maintain within-group order and cohesion, which ultimately benefits all group members (Kakkar and Sivanathan 2017; Laustsen and Petersen 2017). In the meantime, the information-sharing and cooperation-facilitating qualities of prestigious strategies (Henrich and Gil-White 2001) may be devalued during times of danger and conflict, when survival is prioritized over long-term development. Consistent with this view, we found that although prestigious leaders consistently received the highest ratings and gaze-following in non-threatening situations, such effects disappeared or reversed in competition-focused situations due to more favourable ratings and increased gaze-following of dominant and mixed leaders. Extrinsic danger cues produced similar results, albeit due to a drop in the gaze-cuing effect of prestigious leaders.

Finally, moderation analyses in Study 1 and correlational patterns between eye-tracking and gaze-cuing data in Study 2 provided preliminary evidence regarding the context-contingent association between visual attention patterns and leader-following tendencies. Overall, higher DTR, which reflected diminished readiness to process prestigious traits, was negatively associated with evaluation ratings of prestigious leaders in the face of competition-focused threats and negatively associated with gaze-cuing of prestigious leaders in neutral or danger-focused situations. The relationship between DTR and tendencies to follow mixed leaders was less consistent across different measures, showing a negative correlation with evaluation ratings but a positive correlation with gaze-cuing in the competition-focused situation. Overall, this points to different underlying cognitive mechanisms for these two measures of leader-following tendencies. Specifically, gaze-cuing is associated with the desirability of the objects that the person in question is gazing at, but not necessarily the desirability of the person (Bayliss et al. 2006). Greater gaze-cuing effects might implicitly indicate that the leader is worth following for locally valuable information (Dalmaso et al. 2012, 2014), but not necessarily worthy of praise and approval. Such deviation manifested for mixed leaders in zero-sum competitive situations, where people are likely to struggle between following the leaders who are dominant competitors and condemning the exploitation of such overly competitive leaders. Thus, similar visual attention patterns might contribute to different behavioural tendencies in such situations. Admittedly, these are speculations given that we did not manipulate visual attention. Future investigations can build on our findings and further examine the relationships among situational threats, visual processing of leader characteristics and leader-following tendencies.

As one of the first studies using eye-tracking to investigate the effects of threat contexts on variations in visual attention patterns and leader-following tendencies, our studies inevitably contained some limitations. First, the sample and the artificial nature of the leadership descriptions may limit generalizability to real-world leadership settings, especially under threat. As our participants mostly constitute college students studying in a safe, wealthy city, they may have difficulty vicariously experiencing threatening environments through reading bogus news stories. However,

during the debriefing of both studies, we asked the participants to comment on the experimental manipulation. Most participants (80 of 89 in Study 1, 55 of 61 in Study 2) believed the stories were vivid and convincing. Moreover, from an evolutionary perspective, having personal experiences of adversity may not be necessary to trigger the instinctive, context-contingent responses underlying leadership preferences. Nevertheless, future investigations would benefit from using other paradigms that more closely resemble real-world situations of leadership choices than hypothetical scenarios.

Cultural and language factors might also limit the generalizability of our findings. The fixation patterns of Chinese characters are unique in that it is a non-phonetic language. However, this should not undermine the fundamental interpretation of the eye-tracking data. Across reading research in various languages, contextual predictability and word probability had similar effects on fixation duration (Balota et al. 1985; Ehrlich and Rayner 1981; Inhoff and Rayner 1986; Vitu 1991). In Chinese reading, words with higher stroke counts tend to receive longer fixations (e.g., Pan et al. 2022; Yan et al. 2025). Since we have controlled stroke numbers in our material, however, this factor should not affect the interpretation of our results. Other than the language factor, our participants are likely influenced by the Chinese cultural ethos that emphasizes education and social learning (Zhu and Chang 2019), which might lead to prestige biases. Cultural influences are not necessarily incompatible with the ecological adaptive perspective. Heterogeneous cultural adaptations and leader-following tendencies across diverse cultures might result from variations in historical ecologies and moderate people's perceptions and behaviours in current ecologies (Lonati and Van Vugt 2024). Future research on leadership perception and leader-following tendencies would benefit from cross-cultural designs that allow explicit tests of interactions between cultural and ecological factors.

5 | Conclusion

The current study shed light on the subtle variations in visual attention patterns underlying changes in leadership perception and leader-following tendencies under threatening contexts (in contrast to non-threatening contexts). In particular, we found that zero-sum competition consistently enhanced the readiness to process dominant traits, more so than extrinsic dangers visually. Threat contexts also promoted evaluations of dominant and mixed leaders, thereby facilitating the tendencies to follow their gazes. All these findings corroborated the ecological adaptive claim that leadership perception and leader-following tendencies are not static but flexibly adjust in ways that generally maximize individuals' fitness given local threats and opportunities.

Acknowledgements

We thank Prof. Mark Van Vugt for his invaluable feedback on an earlier draft of the paper. We also wish to thank Yuqi Hao for her technical support, as well as the experimenter team—Lanlan Zhang, Yinuo Zhang and Xinyang Zhou—for their dedicated contributions.

Funding

This research has been funded by a chair professor grant (CPG2024-00002-FSS) from the University of Macau.

Ethics Statement

Both studies were approved by the Department of Psychology at the University of Macau (approval code: 2023-19R1). We confirm that the manuscript adheres to ethical guidelines specified in the APA Code of Conduct as well as local ethics guidelines of Macau SAR, PRC. The research is conducted ethically, results are reported honestly, the submitted manuscript is original and not (self-)plagiarized, and authorship reflects individuals' contributions of all authors.

Consent

All participants signed an online consent form indicating their understanding of the research and their rights before participating in the studies.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data, material and code availability: Original data, materials for the main tasks (in Simplified Chinese, which is the language used by the participants) and measures (with description of coding) have also been made publicly available on the Open Science Framework (OSF) website and can be accessed at https://osf.io/3ukcm/?view_only=None. Study 2 is preregistered at the OSF website, with view-only (anonymous) links listed below: https://osf.io/fd3je/?view_only=bf6daef99ef54a3b9751d0f3e4253b23.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.

Supporting File 1: ejsp70048-sup-0001-SuppMat.docx