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The Spatial Representation of Leadership Depends on Ecological Threat: A Replication and Extension of Menon et al. (2010)

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Since humanity's first steps, individuals have used nonverbal cues to communicate and infer leadership, such as walking ahead of others. Menon et al. (2010) showed that the use of spatial ordering as cue to leadership differs across cultures: Singaporeans were more likely than Americans to represent leaders behind rather than in front of groups. Furthermore, they showed that threat priming increases the representation of leaders at the back. We replicate and extend these findings. We draw on cultural tightness theory to explain variability in mental representations of leadership, advance the spatial precedence hypothesis that leaders are generally represented in the front, use a large cross-cultural sample to compare different cultural dimensions, and employ alternative operationalizations of threat. We show that leaders are generally represented in frontal spatial positions across 25 countries and in different types of teams. We also find that cultural tightness and ecological threat (pandemic, warfare, and predation) lead people to represent leaders at the back (Studies 1–5). Mediation models show that ecological threat triggers greater desire for tightness and norm-enforcing leaders, which in turn leads people to represent leaders at the back (Study 4). Likewise, in tightly regulated work-teams, leaders are thought of as being seated at the office's back desk (Study 5). Thus, we converge with Menon et al. that different cultures have different mental representations of leaders and individuals who face threats show greater preference for leaders at the back. Additionally, we demonstrate that cultural tightness is the key cultural predictor of mental representations of leadership.

Keywords: cultural tightness, leadership, replication, spatial order, threat

Supplemental materials: <https://doi.org/10.1037/pspa0000304.supp>

Since the early ancestors of Homo Sapiens started living in groups to enable coordinated action, group life has become a defining characteristic of our species. In our ancestral history as well as today, the capacity to organize in groups allowed humans to combat threats and thrive. What does the way in which individuals physically organize themselves in a group reveal about their hierarchical rank in that group? One of the first set of hominid footprints dated million years ago is said to reveal a group of individuals that is physically organized in a particular order: The larger, dominant male walks ahead of smaller females and juveniles (Masao et al., 2016). This ancient document bespeaks the significance of nonverbal cues to communicate hierarchical roles of leaders and followers. The

nonverbal communication of leadership is essential for signaling, inferring, and consolidating hierarchical roles, but the study of spatial order cues or whether leaders are represented in front of or behind groups has received little attention with the exception of one article.

Menon et al. (2010) showed in a series of studies that culture influences the way individuals mentally represent a leader's position in a group. They found that individuals from an Eastern culture (Singapore) were more likely than individuals from a Western culture (USA) to represent leaders in a rearward position. Furthermore, managers primed with organizational threat rather than opportunity were more likely to represent leaders at the back. These

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Power analyses, data, code, and materials are available for all studies in the Open Science Framework (https://osf.io/zy2jq/?view_only=None).

Eftychia Stamkou played lead role in conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, validation, visualization, writing of original draft, and writing of review and editing. Astrid C. Homan played supporting role in conceptualization, methodology, and writing of review and editing. Gerben A. van Kleef played supporting role in conceptualization, methodology, and writing of review and editing. Michele J. Gelfand played supporting role in conceptualization, methodology, and writing of review and editing.

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findings were explained in terms of the preferred role of leaders in different cultures: Back leaders are considered more group-focused, an action that is valued in interdependent cultural contexts such as Singapore. Menon et al., (2010) far-reaching findings have greatly advanced leadership scholarship by showing that the fundamental concept of leadership is grounded in spatial representations that are largely shaped by our cultural environments. Our research aimed to replicate Menon et al.'s hypothesis that culture influences the mental representation of leadership, which was tested in their Studies 1A and 3. At the same time, we aimed to extend their findings by testing this idea across a large set of countries, measuring the cultural variables that may account for cultural differences, formulating an additional hypothesis about the universal tendency to represent leaders ahead of groups, and implementing a series of methodological improvements.

In the years since Menon et al.'s (2010) studies were conducted, research on cultural tightness has burgeoned and provided new insights about the role of ecological threat in shaping cultural values and preferences (Gelfand et al., 2011). Although Menon et al. did not specifically test a mechanism for their cultural difference, we examined whether cultural tightness and collectivism account for the observed cultural differences. Relatedly, there is a growing recognition of the importance of using multicountry comparisons when studying cultural effects to assess the generalizability of the findings (Fischer & Poortinga, 2018). Given that Menon et al.'s (2010) work was limited to a 2-country comparison, we tested our hypotheses in a large set of countries and individuals ($N = 4,562$ in 25 countries). We further extended Menon et al.'s research by formally testing an effect that was implied by their findings, the spatial precedence effect, which describes the general tendency to represent leaders ahead of groups (Krause et al., 2002; Schwartz et al., 1982). We substantiated the spatial precedence hypothesis by drawing on interdisciplinary theoretical and empirical accounts. Finally, we corroborated the findings by implementing a series of methodological advancements across five programmatic studies that aimed to generalize findings across a broader array of threats, to rule out methodological confounds, and to test the mediating processes. In what follows, we first review research that supports the spatial precedence hypothesis, we then explain why cultural tightness would moderate this effect, and finally provide an overview of the studies we designed to test our hypotheses.

Spatial Precedence as Cue to Leadership

People make sense of the social world through conceptual metaphors that enable them to understand abstract notions like leadership (Barsalou, 1999; Lakoff & Johnson, 1999; Landau et al., 2010). According to theories of grounded cognition, metaphors provide grounding for abstract concepts by connecting them to more concrete concepts (e.g., "a shallow idea"). By means of such metaphorical connection, the structure inherently present in a concrete concept (shallowness) is mapped onto the abstract concept (idea). The concrete concepts in turn take their structure from image schemas, which are mental representations that emerge from recurring perceptual and action experiences as we interact with the world (e.g., Hampe & Grady, 2005; Kovecses, 2010). Evidence for this idea originates from metaphorical expressions in language. For example, people regularly talk about hierarchy concepts by mapping them onto a spatial dimension, as shown in common metaphorical

expressions that describe a powerful person as being "the top dog" (vertical space) or a chairperson as leading "from the front" (horizontal space). Conceptual metaphors thus provide ways to both represent and communicate about the social world.

Several strands of research suggest that people mentally represent hierarchical relations using different spatial cues of order and magnitude (Fiske, 1992). With regard to spatial magnitude cues, past research demonstrates that attributes or behaviors that consume space, such as physical height, expansive postures, and keeping small interpersonal distances from others are associated with hierarchical rank (see Schubert, 2020 for a review). Similarly, higher positions on the vertical spatial dimension denote elevation and are associated with higher rank. For example, when reading labels of social groups on the screen, participants react faster when powerful groups are presented on the higher vertical space (e.g., Lu et al., 2017; Schubert, 2005). Although previous research established that space-consuming attributes and spatial elevation on the vertical plane denote magnitude and are therefore associated with hierarchical rank, little insight exists about the relationship between leadership and spatial ordering on the horizontal plane (Menon et al., 2010).

Anthropological theories and ethnographic fieldwork suggest that spatial order cues are used to classify people into leaders in the forefront and followers at the back (Fiske, 1992). Early sociological theories similarly contend that spatial precedence is a universal cue to hierarchical rank, with higher-ranking individuals being placed in front of their inferiors who follow behind (Pikulski et al., 1976). Accordingly, the etymology of the word leader in many languages denotes precedence, such as *princeps* in Latin, associated with the Roman emperors and meaning to arrive first in time or order; *hegemon* (ἡγεμών) in ancient Greek meaning to precede others and show the way; and *lædere* in old English meaning to go before others as a guide (Hofmann, 1966; Vaan, 2016). On the other hand, the etymology of the word follower in many languages is associated with being the one who postdates in time, goes after in space, and adheres to others' ideas (e.g., *folgere* in old English, *sectator* or *discipulus* in Latin). The spatial expression of this contrast between front and back positions may be rooted in the tendency to allocate attention to foregrounded as opposed to backgrounded objects (Taylor & Fiske, 1978). Higher-ranking individuals who are at the forefront are thus guaranteed visibility and physical presence by virtue of their spatial position. Through repeated exposure to everyday situations in which leaders have spatial precedence (e.g., generals walking in front of sergeants, CEOs sitting at the head of the table, officers leading military parades, and leading members of political parties sitting on the front bench in the parliament), people form associations between leadership and frontal spatial positions. These associations in turn shape the way people think about and mentally represent hierarchical relations on the horizontal plane (Barsalou, 1999; Fiske, 1992; Landau et al., 2010). A few empirical studies indirectly support the notion that higher-ranking groups are positioned ahead of lower-ranking ones in both words and pictures. For instance, for English speakers the name order of "Freddy and Tammy" reads more fluently than the reverse order, a preference that persists after controlling for name-order regularities (Bodine, 1975; Wright et al., 2005); paintings of male-female pairs (e.g., Adam and Eve) over-proportionally portray the male to the left of the female, which is consistent with the left-to-right trajectory in visual perception (Maass et al., 2009);

individuals draw first the powerful groups in statistical graphs and then the weaker ones (Hegarty et al., 2010); and human-like figures that are depicted as standing in front of others are considered more dominant than figures at the back (Schwartz et al., 1982).

Direct evidence for the role of spatial precedence as a cue to leadership stems from research on nonhuman animals. Among nonhuman social mammals, leadership is often defined as an individual's tendency to depart first or walk in front of the group (Krause et al., 2002). From gorillas, bonobos, and chimpanzees to wolves, elephants, and killer whales, empirical research on conspecifics' collective motion shows that higher-ranking individuals tend to occupy a frontal position in the group (e.g., Brent et al., 2015; Fossey, 1972; Furuichi, 1997; Tokuyama & Furuichi, 2017), which allows them to direct the group's movement (Couzin et al., 2005) and to gain first access to limited resources (see Garfield et al., 2019 for a review).

Given the pervasiveness of leaders' spatial precedence across species and the symbolic expression of rank as being ahead of others in language, we expected that spatial precedence will act as a cue to leadership in humans across cultures. In fact, Menon et al. (2010) reported results consistent with this expectation but did not formally test it. For instance, their Study 1A shows that 86.84% of the total sample chose the front figure as leader of the group while only 13.16% chose the back figure, and their Study 3 shows that 42.37% of the total sample chose the front figure while only 11.86% chose the back figure. We therefore tested the spatial precedence hypothesis in all studies and synthesized the results in a meta-analysis that allowed estimating the effect size across original and replication studies. Next, we theorize that the general tendency to represent leaders ahead of groups is moderated by the cultural context.

Threat and Spatial Cues to Leadership Across Cultures

Classic theories of grounded cognition suggest that mental representations of abstract concepts, such as leadership, are tied to the body's sensory-motor system and experiences (e.g., leader = walking ahead; e.g., Landau et al., 2010). However, the development of such associations between abstract concepts and bodily experiences is situated in a sociocultural context replete with needs, constraints, and values that may shape the meaning of leadership. This idea is in line with theories of situated grounded cognition, which suggest that the intimate link between body and its associated mental representations can be informed by cultural norms, practices, and social interactions habitually encountered in a given context (Cohen et al., 2009; Cohen & Leung, 2009; IJzerman & Koole, 2011; Leung et al., 2011; Varela et al., 1991). This approach acknowledges the cultural affordances that underlie the emergence of certain conceptual metaphors, thereby placing grounded cognition in a sociocultural context. As said by Lakoff and Johnson (1999), "our conceptual systems draw largely upon the commonalities of the environments we live in." As such, our cultural ecologies constitute the basis on which concrete sensory-motor states and abstract concepts are connected, thereby creating cultural variation in conceptual metaphors and associated mental representations.

In keeping with this view, Menon et al. (2010) show that the prevalence of spatial precedence as cue to leadership differs when comparing individuals from different cultural contexts. In their Study 1A, Singaporeans were relatively more likely to represent leaders at the back of the group as compared to Americans. The

authors explained this finding by arguing that as Singaporeans are relatively more interdependent than Americans (Markus & Kitayama, 1991), they may expect their leaders to take actions that focus on the group in order to protect it—an action that is facilitated by the leader's rearward position. Accordingly, their Study 2, which examined perceived qualities of leaders who were presented in different positions, found that Singaporeans considered back leaders more group-focused than did Americans. Finally, their Study 3 showed that managers primed with organizational threat—a situation that should evoke protective action—were relatively more likely to represent leaders at the back than managers primed with opportunity. Although Study 1A evinces a cross-cultural difference between an Eastern and a Western country, no conclusion can be drawn about the underlying cultural dimension accounting for these differences because the two cultures likely differ in multiple ways. Furthermore, the fact that threat priming in Study 3 generates the same pattern of findings as Study 1A points to underlying processes that might be related to cultural tightness, as there is a close association between threat and tightness (e.g., Gelfand et al., 2011). We therefore offer an alternative theoretical framework to account for these findings and propose that cultural tightness is the key cultural dimension that alters the default tendency to represent leaders in the front.

Cultural tightness is intimately connected with ecological threat. Research has found that high levels of threat in human ecologies increase the need for strong norms and severe punishment of deviant behavior in the service of social coordination for survival (Roos et al., 2015). Accordingly, ecological contexts where coordination among community members is needed (e.g., rice cultivation regions) lead to tighter community norms (Talhelm & English, 2020; Talhelm et al., 2014). On the contrary, low levels of threat allow for cultural populations with weaker norms and higher tolerance for deviant behavior. A burgeoning body of data shows that societies that have historically faced high degrees of territorial threats (e.g., wars), pathogen prevalence (e.g., tuberculosis, pandemics), and natural disasters (e.g., droughts, floods) developed stronger norms that helped them deal with threat and evolved to be more *tight* than societies that chronically faced lower levels of ecological threats which evolved to be more *loose* (Gelfand et al., 2011; Harrington & Gelfand, 2014; Roos et al., 2015). Case in point, nations that are tighter were more effective in their coronavirus disease (COVID-19) response during the pandemic: They coordinated much faster, resulting in lower infection and higher survival rates than loose nations (Gelfand et al., 2021). The close association between historical exposure to threat and cultural tightness is corroborated by their high correlation at societal- and state-level (Chua et al., 2019; Harrington & Gelfand, 2014; Jackson et al., 2020). Likewise, recent studies show that momentarily increasing the salience of intergroup threat enhances the desire for tightly regulated societies and authoritative agencies who punish their disciples (Caluori et al., 2020). Thus, both situational threats and historical exposure to threats encapsulated in cultural tightness foster a greater need for social order and norm enforcement. These needs in turn should influence the representation of leaders' spatial position, which provides critical information for managing threats.

Cultural tightness may also influence the way people think about the purpose and qualities of leaders, which in turn shapes the way leaders are mentally represented. Individuals across cultures hold different implicit beliefs about the qualities that make a good leader (Phillips & Lord, 1986). Desired leadership qualities vary widely

across cultures, as groups and their leaders need to adapt to their local ecologies. A cross-cultural study across 62 countries, for instance, showed that individuals across cultures had strikingly different views about the leadership qualities that were considered conducive to effective leadership, such as being modest, directive, or a micromanager, depending on prominent cultural values (House et al., 2004). Tight cultures, for instance, value adherence to rules and have developed strong institutions and authorities that enforce them as a way of dealing with the need to coordinate under threat. Therefore, tight cultures may favor leaders who are disposed to enforce the rules to ensure coordination in the face of threat. On the contrary, loose cultures value creativity and innovation, which is reflected in their preference for charismatic leaders (Aktas et al., 2016). Leaders who embody these qualities would then be considered more effective in specific cultural contexts (Phillips & Lord, 1986). These culturally shaped expectations of leaders make individuals respond differently to leaders' spatial positions, since these positions are associated with different qualities that may be a stronger or weaker fit in certain cultures. Distinct leadership qualities, such as norm enforcement or charisma, may be symbolized through different spatial positions in the group (Pfeffer, 1981), thereby creating associations between spatial positions and leadership qualities. Accordingly, we expected that a leader who follows after the group may be seen as more norm-enforcing than a leader who walks ahead of the group, given that the rear position allows leaders to supervise everyone's behavior and to monitor the group. A Supplemental Study empirically supported this idea by showing that leaders who follow behind groups were perceived as more norm enforcing than leaders going ahead of groups (see Supplemental Study 1).

Finally, the notion that ecological threat is driving the effect of cultural tightness on mental representations of leadership is also consistent with ethological studies. Ethological research shows that leaders within moving groups are not consistently found in the front and their position in predicted by ecological threat (Bode et al., 2012). A field experiment among chimpanzees showed that the alpha male increased his rearward presence when the group was crossing a large road that was busy with traffic, and thus threatening, compared to a smaller and safer road that was used by pedestrians (Hockings et al., 2006). Furthermore, among chacma baboons, adult males and females were at the front and back of the progression, whereas juveniles were located in the center where they were less exposed. Adults' tendency toward the back of progressions was intensified in potentially dangerous situations, such as the presence of predators (Sueur, 2011). These findings suggest that in nonhuman primates, leaders' spatial position helps the group to produce adaptive responses to threat, which may explain why leading nonhuman animals sometimes position themselves at the back—a strategic position for leaders to increase their viewshed and monitor the group. Thus, ethological research provides evidence consistent with the notion that threatening ecological conditions can urge leaders to change their default position from the front to the back.

In sum, diverse evidence from ecological theories of culture, implicit leadership theories, and ethological studies on nonhuman primates converge to suggest that threatening ecological conditions and associated cultural tightness cause variability in the representation of leaders' spatial position. We examined the influence of cultural tightness and ecological threat in a series of studies that included a culturally diverse sample, complementary

methodologies, and novel manipulations of threat. Our studies thus allowed replicating the hypothesis advanced by Menon et al. (2010) that culture influences the spatial representation of leadership, which was tested in their Studies 1A and 3.

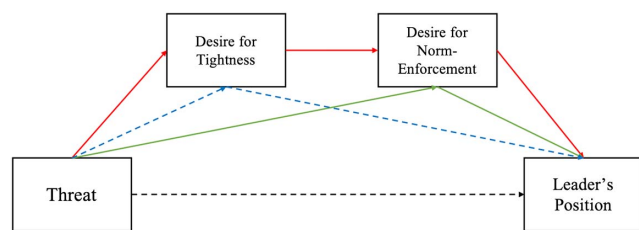
Hypotheses and Overview of Studies

Given the pervasiveness of leaders' spatial precedence across species, we hypothesized that leaders are more likely to be represented in the front rather than back spatial position (spatial precedence hypothesis). However, given that spatial order cues are situated in cultural environments that shape the meaning of leadership, we hypothesized that ecological threat—evoked situationally or consolidated in cultural tightness—increases leaders' relative representation at the back of the group (moderation hypothesis).

To test our hypotheses, we conducted five studies. Study 1 uses original data from 25 countries to test whether leaders are universally represented in the front, whether cultural tightness increases the relative representation of leaders at the back. Studies 2, 3, and 4 manipulate ecological threat—the historical correlate of cultural tightness—to assess the causal effect of threat on the representation of leaders' spatial position. The operationalization of ecological threat as pandemic, warfare, and predation in Studies 2–4 provides converging evidence from different contexts where threat occurs. Studies 2–4 also rule out potential confounds and test underlying processes accounting for the effect of threat on leaders' spatial position. Specifically, Study 2 examines the effect of pandemic threat on leaders' spatial position. Study 3 investigates the effect of warfare threat and rules out the alternative accounts that the effect of threat on representation of leaders' position is driven by negative affect or participants' habitual reading direction. Study 4 examines the effect of predation threat as well as the link among threat, desire for tightness, desired leadership qualities, and representation of leaders at the back in a serial mediation model. Furthermore, Study 5 manipulates desire for tightness to examine its effect on leaders' spatial position as evidenced in an organization's office design and addresses endogeneity issues introduced by the cross-sectional design of Study 4. Finally, we conducted two meta-analyses that synthesized the results of our studies and Menon et al.'s studies to provide reliable estimates of the spatial precedence and moderation effects. Thus, the current research harnesses the respective benefits of large-scale cross-cultural data, experiments, mediation analyses, and meta-analytic models to allow for converging evidence from complementary methods.

Because we focused on individuals' mental representations of leadership, we used visual scenarios across studies to depict teams walking in file, where individuals were asked to indicate the person they considered to be in charge of the team (see Figure 1 for an example of a full scenario). Across studies, we avoided using the word "leader" in the instructions, because it implies a frontal position in several languages. We also used figures of same stature, size, and posture to control for other visual cues related to leadership. We varied the team size (i.e., 2–6 members) across studies to generalize the effect to teams of different size, depicting members in the front, middle, and back positions. Since our hypotheses concern the representation of leaders' spatial position with regard to a front versus back contrast, the analyses reported below focus on this

Figure 1
Serial Mediation Model Depicting the Links Between Threat, Desire for Tightness, Desire for Norm-Enforcing Leaders, and Leader's Position in Study 4



Note. Solid arrows represent significant effects and dashed arrows represent nonsignificant effects. See the online article for the color version of this figure.

contrast. Additional results for other contrasts are reported in the [Supplemental Material](#).

In keeping with guidelines for open science, we report in each study all manipulations, measures, and manipulation checks. Power analyses, data, code, and materials are available for all studies in the Open Science Framework (https://osf.io/zy2jq/?view_only=None). All analyses reported in the main text are conducted on full samples with no participants excluded, unless participants failed to attend to a key element of a study (see [Supplemental Material](#) for additional full sample analyses checking robustness of results). The current research was reviewed and approved by the Ethics Review Board of the University of Amsterdam, and all participants consented to participate. In all power analyses we sought to obtain high statistical power (95%) and used the effect size observed in Studies 1A and 3 by Menon et al. (2010). All statistical analyses reported are two-tailed.

Study 1: Leader's Position Across Cultures

Study 1 examined whether people across cultures represent leaders in the front (spatial precedence hypothesis) and whether this tendency is weaker in tighter cultures (moderation hypothesis). Study 1 thus sought to test Menon et al.'s (2010) hypothesis that culture influences individuals' mental representation of leadership, using participants from 25 rather than two countries and measuring the cultural variables of interest, that is, cultural collectivism and tightness.

Method

Participants

In Study 1 we aimed to recruit approximately 100 participants in all countries where we had access to participant pools. We recruited 3,183 individuals ($M_{\text{age}} = 26.42$, $SD_{\text{age}} = 9.47$, 61.6% female) from 25 countries (Australia, Austria, Brazil, China, France, East Germany, West Germany, Greece, Hungary, Israel, Japan, Mexico, the Netherlands, New Zealand, Pakistan, Poland, Portugal, Romania, Saudi Arabia, Singapore, South Korea, Taiwan, U.K., U.S., and Zambia) that spanned the range of tightness based on previous research (Gelfand et al., 2011).¹ Although in few countries we were not able to reach the required

sample due to time constraints or limited access to participant pools (Romania, Saudi Arabia, and Zambia), in all remaining countries the sample closely approximated or exceeded the target sample. Data was collected before the COVID-19 pandemic. Sample characteristics per country (demographics and cultural value scores) are displayed in [Supplementary Table 1](#).

To estimate whether Study 1 was sufficiently powered, we implemented a computer simulation using the web application Psychometrosar, which is designed to estimate achieved power for multilevel logistic regression models (Olvera Astivia et al., 2019). The simulation indicated that, given the average number of individuals per country, number of countries in our sample, and the coefficients we observed in the multilevel logistic regression analysis, the achieved statistical power for all effects of interest was at least 0.95, which indicates that Study 1 was sufficiently powered.

Materials and Procedure

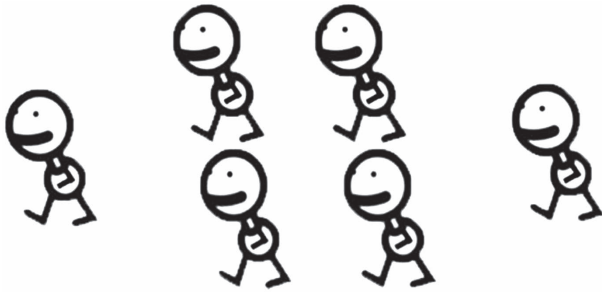
All materials were translated to each country's official language based on a back-translation procedure, which we explain in the [Supplemental Material](#) (Brislin, 1986). The survey was administered online in all countries with the exception of Japan, Pakistan, Saudi Arabia, and Taiwan, where we used a pen-and-paper version of the questionnaire, and Singapore and Zambia, where we used both administration modes. For online surveys, participants were recruited via the online system of a local university (e.g., www.lab.uva.nl/lab in the Netherlands). For pen-and-paper surveys, participants were recruited at university lecture halls.

After demographic questions (age, gender, education, socio-economic status, and religiosity), we assessed individuals' representation of leader's position with a multiple-choice question that referred to a picture of a 6-member group walking in linear ordering ("Who do you think is in charge of this group?"; see [Figure 2](#)). The stick figures were race-, ethnicity-, and gender-neutral, which ensures equivalence in participants' familiarity with the stimulus material across countries (methodological equivalence). The image of the stick figures was adapted from the stimulus materials Menon et al. (2010) used in their Studies 2 and 3.

We then assessed cultural tightness and collectivism. In keeping with the descriptive norm perspective on culture (Chiu et al., 2010; Shteynberg et al., 2009), we conceptualized tightness and collectivism as collective constructs that reside at the culture level. We therefore measured them in line with a referent-shift consensus model, which requires individuals to evaluate a cultural characteristic at the desired culture-level of analysis (e.g., "People in this country do X") to indicate a crystallized collective-level construct (Chan, 1998; Fischer, 2009). We measured cultural tightness using the 6-item tightness-looseness scale that was answered on 6-point Likert scales (e.g., "In my country there are many social norms that people are supposed to follow 1 = *strongly disagree* to 7 = *strongly agree*").

¹ The use of the term country refers to sociocultural entities rather than political entities. We therefore treated China (officially People's Republic of China) and Taiwan (officially Republic of China) as separate cultural units, and used different translations in each country. We also included East and West Germany as separate cultural units to be consistent with previous cross-cultural studies (Gelfand et al., 2011; Oettingen et al., 1994).

Figure 2
Image Used to Measure Leader's Spatial Position in Study 1



agree”; Gelfand et al., 2011). We measured cultural collectivism using the 5-item collectivism scale that consisted of 7-point bipolar items (e.g., “Most people in my country ... 1 = *do what is enjoyable to them personally* vs. 7 = *carry out their group obligations*”; Fischer et al., 2009). We provide the full list of the tightness and collectivism items in the [Supplemental Material](#).

Results

Analysis Strategy

We conducted multilevel logistic regression analysis to test the effect of cultural tightness on individuals' selection of the leader's position, after controlling for demographics and cultural collectivism. Multilevel analysis allowed us to model the effects of individual-level (i.e., demographics and leader position selection) and country-level (i.e., collectivism and tightness) covariates (Raudenbush & Bryk, 2002). Before carrying out multilevel analysis, we performed a number of preliminary analyses to check the feasibility of multilevel analytical techniques. The preliminary analyses were carried out in three steps. First, we assessed the internal consistency of each scale within each country by means of Cronbach's α reliability analyses. The average reliability across countries was sufficient for tightness ($\alpha_{\text{mean}} = .62$, $SD = 0.08$) and good for collectivism ($\alpha_{\text{mean}} = .84$, $SD = 0.05$). Second, we checked whether the within-country agreement was sufficiently high for the tightness and collectivism scales by estimating the $r_{wg(J)}$ index for tightness [$r_{wg(J)\text{-mean}} = .86$, $SD = 0.08$] and collectivism [$r_{wg(J)\text{-mean}} = .72$, $SD = 0.20$]. The $r_{wg(J)}$ values exceeded the recommended .70 cutoff point, indicating high within-country agreement and justifying aggregation of individual scores to the country level (LeBreton & Senter, 2008). Third, we tested for measurement invariance of the tightness and collectivism scales to examine whether the psychological construct underlying each scale has the same structure across countries, that is configural equivalence (Cheung & Rensvold, 2002; van de Schoot et al., 2012). The results of this analysis, which provided evidence for configural equivalence, are presented in the [Supplemental Material](#).

Next, we did a frequency analysis to check the distribution of responses across the categories of the dependent variable (leader's position). This analysis revealed that at least one of four middle-position categories in at least one country was never selected, thereby creating zero-frequency cells (see [Table 1](#)). Since zero-frequency cells are excluded from logistic regression analyses, we applied the

common remedy of collapsing participants' scores across the four middle categories (Snijders et al., 1999). Thus, the dependent variable included in follow-up analyses had three levels: Front, middle, and back. After the preliminary and frequency analyses, we conducted a multilevel regression analysis using a nested-models approach.

Nested Models

We conducted a multilevel logistic regression analysis in Mplus to estimate the effect of tightness on participants' selected leader position after controlling for the effect of demographics and cultural collectivism. This analysis tested three nested models, where Model 1 (empty model) estimated country variability without including any covariates; Model 2 estimated the effect of control variables (demographics and cultural collectivism); and Model 3 estimated the effect of cultural tightness above and beyond control variables. Parameter estimates of consecutive models testing the back versus frontal position contrast are displayed in [Table 2](#) (for the back vs. middle position contrast, see the [Supplemental Material](#)).

Next, we compared the fit of Model 3–Model 2 by means of a chi-square difference test and the proportional change in variance index (PCV), which quantifies the amount of between-country variance explained by consecutive models with additional terms (Merlo, Yang, et al., 2005). Model 3 was a better fit to the data than Model 2, $\chi^2(2) = 10.95$, $p = .004$, explaining 43.38% more variance in participants' choice for the back versus front position.

Consistent with the spatial precedence hypothesis, participants across countries were more likely to select a leader in the front (70.5%) rather than back position (21.1%), $b = 1.24$, $SE = 0.11$, $p < .001$, 95% CI [1.03, 1.45]. However, the relative preference for the front over back position varied significantly across countries, $b = 0.22$, $SE = 0.08$, $p = .005$, 95% CI [0.07, 0.38]. When cultural tightness was added to the model, a significant effect emerged, $b = -1.36$, $SE = 0.37$, $p < .001$, 95% CI [-2.09, -0.63]. Probing the effect showed that, as predicted, individuals in tighter countries were relatively more likely to represent leaders at the back of groups as compared to individuals in looser countries (see [Figure 3](#)). Importantly, the effect of cultural collectivism on individuals' choice of a leader's position was not significant, $b = 0.17$, $SE = 0.16$, $p = .308$, 95% CI [-0.15, 0.49], indicating that collectivism did not influence individuals' relative preference for the front over back position.

Odds Ratio Analysis

Next, we carried out odds ratio analyses to probe the distribution and size of effects in our final model (see [Table 3](#)). For individual-level covariates, we estimated common odds ratios. For country-level covariates, we estimated the 80% Interval Odds Ratio (IOR-80; Merlo, Chaix, et al., 2005; Merlo et al., 2006). The IOR-80 is a measure of association and is defined as the interval centered on the median of the distribution that comprises 80% of the values of the odds ratio, when comparing all possible pairs of persons with a higher score on a country-level variable to persons with a lower score on the same variable. If the interval does not contain the value one, the effect of the country-level variable explains a significant amount of the residual cluster heterogeneity. In our final model, the IOR-80 for tightness was rather narrow and did not contain 1 [0.14, 0.49], whereas the IOR-80 for collectivism was rather wide and contained

Table 1*Distribution of Participants' Choice of Leader's Position Across Countries in Study 1*

Country	Front	Middle upper left	Middle upper right	Middle lower left	Middle lower right	Back	Total
Australia	90 (69.8%)	2 (1.6%)	3 (2.3%)	1 (0.8%)	0 (0%)	33 (25.6%)	129
Austria	117 (77%)	12 (7.9%)	2 (1.3%)	4 (2.6%)	0 (0%)	17 (11.2%)	152
Brazil	88 (71.5%)	2 (1.6%)	0 (0%)	1 (0.8%)	6 (4.9%)	26 (21.1%)	123
China	124 (57.9%)	8 (3.7%)	6 (2.8%)	7 (3.3%)	3 (1.4%)	66 (30.8%)	214
France	84 (66.1%)	4 (3.1%)	2 (1.6%)	6 (4.7%)	3 (2.4%)	28 (22%)	127
Germany East	73 (71.6%)	3 (2.9%)	1 (1.0%)	7 (6.9%)	0 (0%)	18 (17.6%)	102
Germany West	86 (72.9%)	7 (5.9%)	3 (2.5%)	4 (3.4%)	0 (0%)	18 (15.3%)	118
Greece	82 (63.1%)	2 (1.5%)	3 (2.3%)	1 (0.8%)	5 (3.8%)	37 (28.5%)	130
Hungary	130 (87.2%)	2 (1.3%)	0 (0%)	0 (0%)	0 (0%)	17 (11.4%)	149
Israel	81 (78.6%)	6 (5.8%)	2 (1.9%)	1 (1.0%)	1 (1.0%)	12 (11.7%)	103
Japan	69 (60%)	4 (3.5%)	2 (1.7%)	1 (0.9%)	0 (0%)	39 (33.9%)	115
Mexico	113 (75.3%)	4 (2.7%)	2 (1.3%)	2 (1.3%)	0 (0%)	29 (19.3%)	150
The Netherlands	115 (88.5%)	2 (1.5%)	1 (0.8%)	2 (1.5%)	0 (0%)	10 (7.7%)	130
New Zealand	79 (69.9%)	4 (3.5%)	4 (3.5%)	3 (2.7%)	1 (0.9%)	22 (19.5%)	113
Pakistan	104 (74.8%)	8 (5.8%)	2 (1.4%)	0 (0%)	1 (0.7%)	24 (17.3%)	139
Poland	103 (75.2%)	7 (5.1%)	0 (0%)	2 (1.5%)	4 (2.9%)	21 (15.3%)	137
Portugal	81 (67.5%)	3 (2.5%)	1 (0.8%)	3 (2.5%)	3 (2.5%)	29 (24.2%)	120
Romania	58 (59.8%)	3 (3.1%)	2 (2.1%)	0 (0%)	0 (0%)	34 (35.1%)	97
Saudi Arabia	62 (76.6%)	3 (3.7%)	3 (3.7%)	1 (1.2%)	0 (0%)	12 (14.8%)	81
Singapore	71 (64%)	4 (3.6%)	2 (1.8%)	7 (6.3%)	1 (0.9%)	26 (23.4%)	111
South Korea	66 (56.9%)	6 (5.2%)	2 (1.7%)	3 (2.6%)	1 (0.9%)	38 (32.8%)	116
Taiwan	109 (70.8%)	4 (2.6%)	1 (0.6%)	3 (1.9%)	2 (1.3%)	35 (22.7%)	154
U.K.	99 (66.2%)	13 (8.8%)	3 (2.0%)	5 (3.4%)	2 (1.4%)	27 (18.2%)	148
U.S.	120 (85.1%)	4 (2.8%)	2 (1.4%)	2 (1.4%)	0 (0%)	13 (9.2%)	141
Zambia	41 (48.8%)	0 (0%)	1 (1.2%)	0 (0%)	1 (1.2%)	41 (48.8%)	84
Total	2,244 (70.5%)	117 (3.7%)	50 (1.6%)	66 (2.1%)	34 (1.1%)	672 (21.1%)	3,183

Note. Percentages may not total 100 due to rounding.

0 [0.62, 2.23], which indicates that tightness accounted for a significant part of country heterogeneity, whereas collectivism did not.

Discussion

Using a large number of countries around the globe, Study 1 demonstrated that spatial precedence is a pervasive cue to leadership across cultures but not an absolute universal: Cultural tightness increases individuals' relative tendency to represent leaders at the

back rather than in the front position in a group. These results are in line with Menon et al.'s finding that Singaporeans are relatively more likely than Americans to represent leaders behind groups. However, the 2-country comparison by Menon et al. (2010) made it hard to determine whether the cross-cultural difference was driven by cultural collectivism and tightness, because Singapore and USA differ on both dimensions. Our study showed that cultural variability in mental representations of leadership is explained by cultural tightness rather than collectivism.

Table 2

Parameter Estimates for Multilevel Logistic Regression Models Testing the Effects of Tightness on Individuals' Choice of a Leader at the Back Versus Front Position After Controlling for Demographics and Collectivism in Study 1

Predictors	Model 1			Model 2			Model 3		
	<i>b</i> (<i>SE</i>)	95% CI	<i>p</i>	<i>b</i> (<i>SE</i>)	95% CI	<i>p</i>	<i>b</i> (<i>SE</i>)	95% CI	<i>p</i>
Measures of association (fixed effects)									
Intercept	1.24 (0.11)	[1.03, 1.45]	<.001	1.24 (0.11)	[1.04, 1.45]	<.001	1.25 (0.08)	[1.08, 1.41]	<.001
Individual-level variables									
Age				0.01 (0.01)	[-0.01, 0.01]	.976	0.01 (0.01)	[-0.01, 0.01]	.977
Gender				-0.24 (0.10)	[-0.43, -0.05]	.015	-0.24 (0.10)	[-0.43, -0.05]	.015
Education				-0.17 (0.10)	[-0.36, 0.01]	.070	-0.17 (0.10)	[-0.36, 0.01]	.070
Socioeconomic status (SES)				0.04 (0.04)	[-0.04, 0.13]	.303	0.04 (0.04)	[-0.04, 0.13]	.305
Religiosity				-0.01 (0.01)	[-0.01, 0.01]	.347	-0.01 (0.01)	[-0.01, 0.01]	.356
Country-level variables									
Collectivism				-0.10 (0.18)	[-0.46, 0.26]	.591	0.17 (0.16)	[-0.15, 0.49]	.308
Tightness							-1.36 (0.37)	[-2.09, -0.63]	<.001
Measures of variation (random effects)									
$\sigma^2_{\text{intercept}}$	0.22 (0.08)	[0.07, 0.38]	.005	0.22 (0.08)	[0.07, 0.37]	.005	0.12 (0.05)	[0.03, 0.22]	.014
ICC		0.06			0.06			0.04	

Note. ICC stands for intraclass correlation coefficient. Parameters in bold represent the effects of interest.

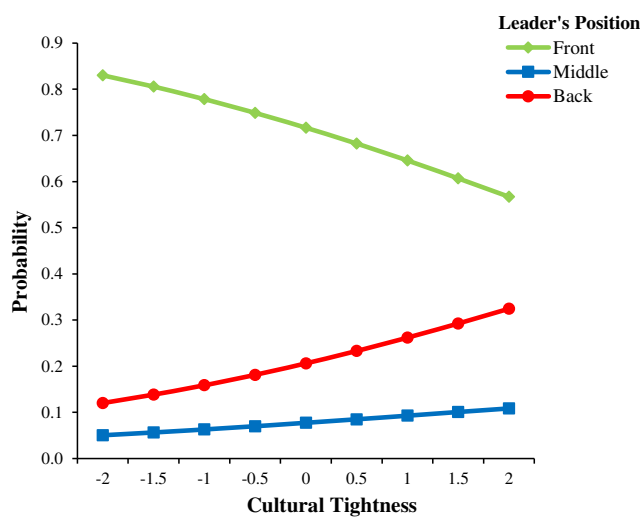
Although our results suggest that cultural tightness influences mental representations of leadership, our findings do not provide causal evidence because of the correlational nature of data in Study 1. We therefore conducted a conceptual replication of Study 3 by Menon et al. (2010) where we manipulated a major correlate of tightness—ecological threat—in three different contexts in Studies 2, 3, and 4.

Study 2: Pandemic Threat and Leader's Position

Study 2 was carried out during the 2019–2020 coronavirus pandemic and examined whether pandemic threat due to the spread

Figure 3

Leader's Position Selection as a Function of Cultural Tightness in Study 1



Note. Plotted predicted probabilities are based on the estimates of Model 3 of the multilevel logistic regression analysis. Cultural tightness scores are standardized about the grand mean. See the online article for the color version of this figure.

of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) influences individuals' representation of leaders' spatial position. Study 2—like Studies 3 and 4—differed in three key ways from Study 3 by Menon et al. (2010). We replaced the human-like stick figures with figures of humans, which were all placed at the same height. Second, Menon et al. (2010) compared a threat priming condition to an opportunity priming condition. We instead compared a high threat condition to a low threat condition because our theoretical framework stipulates high and low occurrence of ecological threat as the determinants of cultural tightness and looseness, but makes no predictions about the cultural impact of ecologies rich in opportunities. Third, we included a manipulation check to examine whether the threat manipulation was successful.

Method

Participants

Study 2 had a similar design to Studies 1A and 3 by Menon et al. (2010), which included a categorical predictor and a categorical outcome. Studies 1A and 3 by Menon et al. (2010) showed effect sizes of $OR = 3.76$ and $OR = 4.30$, respectively, which are on the medium range. Accordingly, our power analysis for Study 2 showed that to detect a medium effect size ($OR = 4$) with a power of 0.95 in a two-sided test with $\alpha = 0.05$, the required sample size is 195 participants. We therefore recruited 200 American citizens ($M_{\text{age}} = 32.86$, $SD_{\text{age}} = 10.52$, 46% female) from Prolific to account for possible exclusions. No participants were excluded from the analyses.

Materials and Procedure

In Study 2 and follow-up studies we asked participants to visualize situations characterized by either high or low levels of threat. This experimental procedure is an emerging ecological priming paradigm in cultural psychology that has been shown to effectively manipulate perceived ecological threat (Gelfand & Lun, 2013), which in turn

Table 3

Odds Ratios for Selecting a Leader at the Back Versus Front Position in Study 1

Fixed-effect variables, varying within clusters	OR [95% CI]
Age	1.00 [0.99, 1.01]
Gender	0.79 [0.65, 0.95]
Education	0.84 [0.70, 1.01]
SES	1.05 [0.96, 1.14]
Religiosity	1.00 [1.00, 1.00]
Fixed-effect variables, constant within clusters	80% Interval OR
Collectivism (low vs. high)	[0.62, 2.23]
Tightness (low vs. high)	[0.14, 0.49]

triggers greater need for tightness (Caluori et al., 2020; Jackson et al., 2021). Participants were randomly assigned to the high or low threat condition via a computer algorithm. Participants read a brief introductory text that was accompanied with an image of a 4-member team: "Below you see a team that works for a food retail company. The team goes from one store to another to complete activities that are necessary for store operation. Every day the team takes the same route. By now, everyone knows the directions." Following, participants in the [high threat/low threat] condition read:

The team works in a city that is [under the coronavirus threat/very safe]. [When the first few cases occurred, public spaces were not disinfected, which caused the virus to spread in areas where people gather/Public spaces are regularly maintained, which creates a pleasant environment for people to hang out.] The city is also [densely/sparsely] populated, which [makes it impossible for people to live far from each other/gives people enough space to have a comfortable living]. [This dangerous situation is worsened/Life quality is further facilitated] by the climate of the city, which functions as an ideal habitat for [the coronavirus/all kind of plants]. People [used to get/are getting] around by metro, busses, and bikes, [but now they can no longer/and they can] freely move from one end of the city to another. Experts are now [worried/confident] that these living conditions will [endanger/secure] the city's prosperity for a long while.

Below the scenario there was an image of a densely populated city in the high threat condition and an image of a sparsely populated city in the low threat condition. After reading the scenario, participants were asked two factual questions to check whether they comprehended the scenario: "The city is ____ populated; 1 = *densely* or 2 = *sparsely*" and "Safety in the city is _____. 1 = *high* or 2 = *low*." Participants who chose the wrong answer were presented with the scenario for a second time.

To measure leader's spatial position, we asked participants to indicate the person they considered in charge of the group (see Figure 4).

Next, we checked the manipulation of threat with three bipolar items that were mean composited into a scale (e.g., "This team works in a city that ... 1 = *is very safe* versus 7 = *is very dangerous*"; "... 1 = *poses no threat* versus 7 = *can pose a serious threat*," and "... 1 = *is a safe territory* versus 7 = *is an unsafe territory*"; $\alpha = .96$).

Results

Participants in the high threat condition, $M = 5.90$, $SD = 0.88$, 95% CI [5.72, 6.09], reported greater perceived threat than participants in the low threat condition, $M = 1.63$, $SD = 0.97$, 95% CI [1.45, 1.82], $F(1, 197) = 1059.90$, $p < .001$, $\eta_p^2 = .84$, thereby providing evidence that the manipulation of threat was successful. We then cross-tabulated threat and leader position to obtain the frequencies and proportions of participants' choice of the leader's position (see Table 4). Next, we performed logistic regression to test the main hypotheses. In line with the spatial precedence hypothesis, participants were more likely to select a leader in the front (64.5%) than back position (27.0%), $b = -0.87$, $SE = 0.16$, Wald (1) = 28.87, $p < .001$. As expected, there was also an effect of threat on the probability of selecting a leader at the back rather than front of the group, $b = 0.83$, $SE = 0.34$, Wald (1) = 6.06, $p = .014$. Odds ratio analysis indicated that, when comparing the high threat condition to the low threat condition, participants were 2.3 times, 95% CI [1.19, 4.46], more likely to select a leader at the back versus front position (see Figure 5).

Discussion

Study 2 replicated the effect of leaders' spatial precedence and provided causal evidence for the effect of pandemic threat on the relative representation of leaders at the back. Our findings are therefore consistent with the results of Study 3 by Menon et al. (2010).

Although Study 2 offers causal support, its respective results may be confounded by negative affect, which is an inherent aspect of threat. In Study 3, we thus included an additional condition that evoked negative affect but was stripped of threat, to rule out the confounding influence of negative affect. Moreover, Study 3 manipulated the group's walking direction (right-to-left vs. left-to-right) to rule out the account that the representation of leaders in frontal or rearward positions may be confounded with individuals' habitual reading direction, which may also influence mental representations (Maass et al., 2009; Maass & Russo, 2003). Finally, Study 3 generalized the findings of Study 2 to a context where threat is inflicted by humans, namely warfare.

Figure 4
Image Used to Measure Leader's Spatial Position in Study 2



Table 4
Distribution of Participants' Choice of Leader's Position in Studies 2, 3, 4, and 5

Condition	Front	Middle Left	Middle Center	Middle Right	Back	Total
			Study 2			
Low threat	69 (69.0%)	9 (9.0%)	—	4 (4.0%)	18 (18.0%)	100
High threat	60 (60.0%)	3 (3.0%)	—	1 (1.0%)	36 (36.0%)	100
Total	129 (64.5%)	12 (6.0%)	—	5 (2.5%)	54 (27.0%)	200
			Study 3			
Low threat	150 (64.4%)	—	—	—	83 (35.6%)	233
Low threat and affect	153 (67.7%)	—	—	—	73 (32.3%)	226
High threat	130 (55.8%)	—	—	—	103 (44.2%)	233
Total	433 (62.6%)	—	—	—	259 (37.4%)	692
			Study 4			
Low threat	94 (75.2%)	1 (0.8%)	4 (3.2%)	1 (0.8%)	25 (20%)	125
High threat	78 (61.4%)	5 (3.9%)	1 (0.8%)	3 (2.4%)	40 (31.5%)	127
Total	172 (68.3%)	6 (2.4%)	5 (2.0%)	4 (1.6%)	65 (25.8%)	252
			Study 5			
Desired looseness	38 (37.6%)	—	35 (34.7%)	—	28 (27.7%)	101
Desired tightness	23 (23.5%)	—	12 (12.2%)	—	63 (64.3%)	98
Total	61 (30.7%)	—	47 (23.6%)	—	91 (45.7%)	199

Note. Percentages may not total 100 due to rounding.

Study 3: Warfare Threat and Leader's Position

Study 3 examined whether warfare threat and the group's walking direction influence individuals' probability to select a leader at the front versus back of the group. The design of Study 3 allowed ruling out the confounding influence of negative affect and group walking direction.

Method

Participants

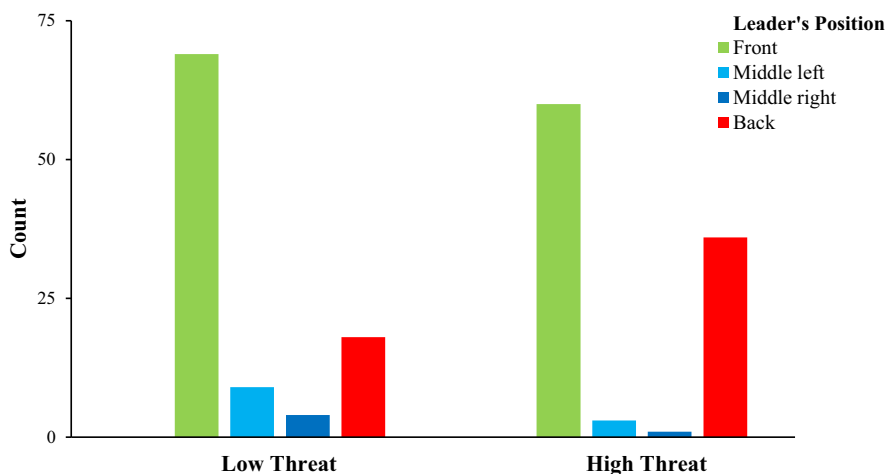
The design of Study 3 included two categorical predictors (threat, walking direction) and one categorical outcome (leader position). We therefore conducted a new power analysis that corresponds to this design. The power analysis showed that to detect a medium effect size ($OR = 4$) with a power of 0.95 in a two-sided test with $\alpha = 0.05$, the required sample size is 696 participants. We recruited 720 American citizens from Prolific to account for possible exclusions. We excluded 28 participants from the analyses, who met at least one of three predetermined exclusion criteria: Two indicated the wrong number of persons in the group; 20 indicated the wrong walking direction of the group; and six participants indicated their data should not be analyzed. The final sample was 692 participants ($M_{age} = 35.00$, $SD_{age} = 12.65$, 50.9% female). Importantly, testing hypotheses on full sample does not change the direction or size of the effects (see [Supplemental Material](#) for robustness checks).

Materials and Procedure

Participants were randomly assigned to one of three conditions via a computer algorithm. Participants read an illustrated story of a 2-soldier taskforce walking in file. Participants in the [high threat/low threat] condition read: "Imagine that you are living in the U.S. in the year 2025. [America is at war with North Korea.² The war was fought overseas at first, but recently the attacks have moved onto American soil/America is a peaceful country, and has avoided being at war for 5 years, with no risk of future conflict.] Many American cities [are occupied by North Korean military/still have military bases that routinely operate to ensure safety]. At the U.S. military base of one of these cities, soldiers engage in [military operations/regular training activities]. A team of two American soldiers has been sent on a [combat/training] mission. The mission aims at [limiting the delivery of supplies to North Korean troops/enhancing the soldiers' stamina]. This mission is very [dangerous/safe], because the American soldiers are operating in [a territory occupied by North Koreans/in guarded American territory]." Participants in the low threat with negative affect condition read the same story as in the low threat condition with the following passage added to the start of the scenario: "Instances of depression and anxiety have increased dramatically within the U.S. Despite the increased

² Our choice of North Korea as political enemy of the US in the high threat condition was guided by previous research (Jackson et al., 2021). Any other non-Asian country could have been chosen instead of North Korea.

Figure 5
Leader's Position Selection as a Function of Threat in Study 2



Note. See the online article for the color version of this figure.

depression rates, America is a peaceful country . . .” We then manipulated the group’s walking direction to be eastward (left to right) or westward (right to left). Participants in the [westward/eastward] condition read: “The soldiers know that they have to move [westward/eastward], so the directions are clear to everyone.” The direction was emphasized by a compass sign on the image.

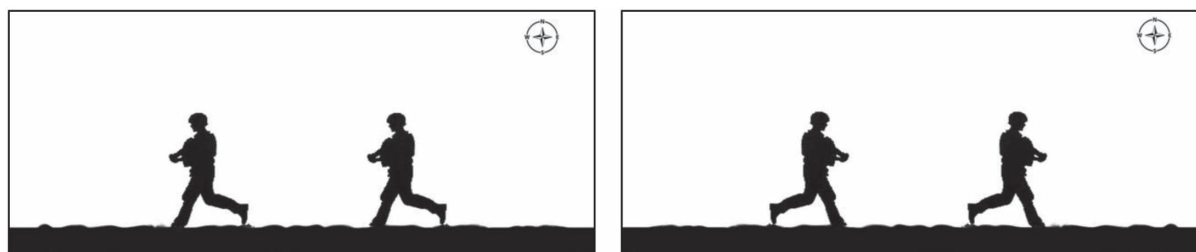
To measure representations of leaders’ spatial position, we presented participants with the image of the soldiers (see Figure 6). Participants then read that one person was in charge of the taskforce by making decisions with regard to the use of resources (water, food) and accomplishment of the mission. They were then asked to choose the person they considered to be in charge (see Table 4 for distribution of participants’ choice of leader’s position). To check the manipulation of threat, we measured perceived threat with the same scale as in Study 3, which we adjusted to fit the current context ($\alpha = .98$). We also measured negative affect with an 8-item validated scale: “I think that people in the U.S. would feel . . . unhappy,” “. . . troubled,” “. . . miserable,” “. . . depressed,” “. . . happy,” “. . . pleased,” “. . . content,” and “. . . hopeful,” with the last four items being reverse-coded ($\alpha = .98$; Feldman Barrett & Russell, 1998). The affect items were answered on 7-point Likert scales ranging from 1 = *strongly disagree* to 7 = *strongly agree*. Moreover, we checked whether participants paid sufficient attention to the

team’s walking direction and number of soldiers with the questions “Which direction was the team headed to?” (answer options: “Eastward” and “Westward”) and “How many soldiers were in the team?” (open-ended question). Participants who failed to provide the right answer to any of these two questions were excluded from the analyses as prespecified in our research protocol. Finally, we asked participants whether we should include their data in the analyses using a validated procedure (Meade & Craig, 2012). After probing for effort and attention with two filler questions, we asked participants to reply with a “Yes” or “No” to the question: “In your honest opinion, should we use your data in our analyses in this study? (Your answer will not affect your payment).”

Results

Participants in the high threat condition, $M = 6.49$, $SD = 0.84$, 95% CI [6.37, 6.61], perceived greater threat than participants in the other two conditions, low threat: $M = 1.60$, $SD = 0.97$, 95% CI [1.48, 1.72]; low-threat-and-negative-affect: $M = 1.65$, $SD = 1.01$, 95% CI [1.53, 1.78], $F(2, 690) = 2065.58$, $p < .001$, $\eta_p^2 = .86$, thereby providing evidence that the manipulation of threat was successful. Furthermore, participants in the high threat condition, $M = 6.33$, $SD = 1.04$, 95% CI [6.18, 6.49], perceived greater

Figure 6
Images Used to Measure Leader's Spatial Position in Study 3



negative affect than participants in the low-threat-and-negative-affect condition, $M = 4.88$, $SD = 1.60$, 95% CI [4.72, 5.04], who perceived greater negative affect than participants in the low threat condition, $M = 1.75$, $SD = 0.93$, 95% CI [1.59, 1.90], $F(2, 690) = 857.18$, $p < .001$, $\eta_p^2 = .71$. Since the low-threat-and-negative-affect condition evoked more negative affect than the low threat condition, we concluded that negative affect was successfully manipulated.

A logistic regression analysis confirmed the spatial precedence hypothesis: Across conditions, participants were more likely to select a leader in the front (62.6%) than back position, (37.4%), $b = -0.51$, $SE = 0.08$, Wald (1) = 42.80, $p < .001$. The effect of walking direction was not significant, $b = .14$, $SE = 0.16$, Wald (1) = 0.81, $p = .369$, which allowed collapsing the data across walking direction conditions in follow-up analyses. As predicted, the effect of threat on the choice of the leader's position was significant when comparing the high threat condition to the low-threat-and-negative-affect condition, $b = 0.51$, $SE = 0.19$, Wald (1) = 6.84, $p = .009$, but only marginally significant when comparing the high threat condition to the low threat condition, $b = 0.36$, $SE = 0.19$, Wald (1) = 3.55, $p = .060$. Odds ratio analysis indicated that, when comparing the high threat to the low-threat-and-negative-affect condition participants were 1.66, 95% CI [1.14, 2.43], times more likely to select a leader at the back versus front. When comparing the high threat to the low threat condition, participants were 1.43, 95% CI [0.99, 2.08], times more likely to select a leader at the back versus front (see Figure 7). Table 4 presents the distribution of participants' choice of leader's position across conditions.

Discussion

Study 3 demonstrated that leaders are generally represented in frontal spatial positions, but warfare threat increases their relative representation at the back, thereby replicating the results of Study 3

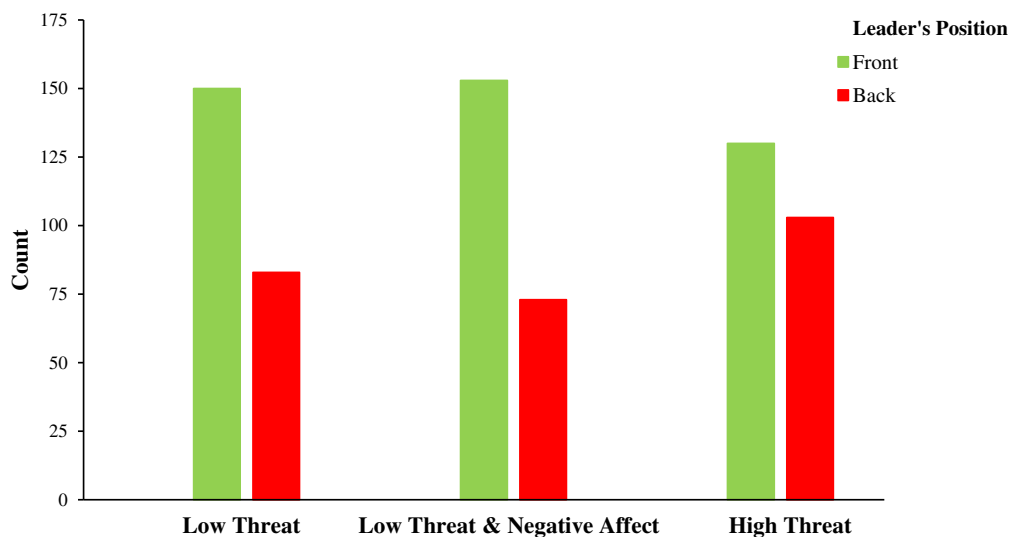
by Menon et al. (2010) and extending them in three ways. First, we replicated the effect in a context that features a manmade threat. Second, we ruled out the account that the effect of threat on leader's position is driven by negative affect, since representation of leaders at the back differed across the high threat condition and the low threat condition that induced negative affect. Third, we eliminated the confound of reading direction, since results did not differ across walking direction conditions.

Although Studies 2 and 3 established the causal effect of threat on leader's spatial position, they provide no evidence for the presumed underlying mechanisms driving this effect. Study 4 thus examined the underlying processes of desire for tightness and norm-enforcing leaders in response to threat. Furthermore, Study 4 generalized the effect to an ecological threat posed by wildlife.

Study 4: Predation Threat and Leader's Position

Study 4 examined individuals' representation of leaders' spatial position in the presence of predation threat, while investigating the underlying processes that may drive this effect in a cross-sectional design. We expected that ecological threat would increase the desire for tight norms in the group and severe punishment of deviant behavior (Gelfand et al., 2011; Harrington & Gelfand, 2014; Roos et al., 2015). Furthermore, in tightly organized groups, leaders may be expected to actively enforce the norms and monitor group members' behavior. We therefore expected that a leader who follows after the group may be seen as more norm-enforcing than a leader who walks ahead of the group, given that the rear position allows leaders to supervise everyone's behavior and to monitor the group (see also results of Supplemental Study 1 for supporting evidence). Accordingly, we tested whether the effect of threat on leader's position is mediated by desire for tightness and desire for norm-enforcing leaders.

Figure 7
Leader's Position Selection as a Function of Threat in Study 3



Note. See the online article for the color version of this figure.

Method

Participants

The estimation of the required sample of Study 4 was based on the observed effect size of Studies 1A and 3 by Menon et al. (2010), which had a similar design to our Studies 2 and 4. The power analysis for Study 2 indicated that we need a sample of 195 participants. However, given that Study 4 included two mediators, we oversampled to account for the mediation analysis. We therefore recruited 252 American citizens from Prolific ($M_{\text{age}} = 33.97$, $SD_{\text{age}} = 11.75$, 54.8% female). No participants were excluded from the analyses.

Materials and Procedure

Participants were randomly assigned to the high threat or low threat condition via a computer algorithm. Participants read an illustrated scenario that consisted of three images accompanied by text that were sequentially presented on screen. Figure 8 displays the visual scenarios we used in the high threat (left panel) and low threat (right panel) conditions.

After presenting the scenario, we sequentially assessed desire for tightness, desire for norm-enforcing leaders, and representation of leader's position in this order because we planned to test a serial mediation model. We assessed desired tightness with three items we derived from the cultural tightness scale we used in Study 1, which were adjusted to fit the context of the study (e.g., "It would be important that the group 1 = have few rules vs. 7 = have many rules"). These items were mean composited into a scale ($\alpha = .83$). We assessed desire for norm-enforcing leaders with a similar scale as in Supplemental Study 1 that was adjusted to fit the hiking context (e.g., "It would be important that the person in charge of this group make sure that others follow the rules"; $\alpha = .85$).

Next, participants read that the group had assigned one person to be in charge of the whole group by making decisions about the use of resources, frequency of breaks, and group actions. We presented participants with the image of the hiking group and asked them to choose the person they considered to be in charge (see top row of Figure 8 for the image). To check whether the manipulation of threat was successful, we assessed perceived threat with the same scale we used in Studies 2 and 3 ($\alpha = .98$).

Results

Participants in the high threat condition, $M = 6.03$, $SD = 1.02$, 95% CI [5.85, 6.20], reported greater perceived threat than participants in the low threat condition, $M = 1.60$, $SD = 0.96$, 95% CI [1.42, 1.77], $F(1, 250) = 1265.03$, $p < .001$, $\eta_p^2 = .84$, which verifies that the threat manipulation was successful. We cross-tabulated threat and leader position to obtain the frequencies and proportions of participants' choice of leader's position across conditions (see Table 4). Next, we carried out logistic regression to test the main hypotheses. In keeping with the spatial precedence hypothesis, results showed that participants across conditions were more likely to select a leader in the front (68.3%) rather than back position (25.8%), $b = -0.97$, $SE = 0.15$, Wald = 44.67, $p < .001$. As expected, there was also an effect of threat on the probability of selecting the back versus front position, $b = 0.66$, $SE = 0.30$, Wald (1) = 4.87, $p = .027$. Odds ratio analysis indicated that,

when comparing the high threat condition to the low threat condition, participants were 1.93 times, 95% CI [1.08, 3.45], more likely to select a leader at the back versus front of the group (see Figure 9).

Furthermore, participants in the high threat condition expressed greater desire for tightness, $M = 6.49$, $SD = 0.83$, 95% CI [6.29, 6.68], than in the low threat condition, $M = 5.33$, $SD = 1.36$, 95% CI [5.13, 5.28], $F(250) = 66.84$, $p < .001$, $\eta_p^2 = .21$, and greater desire for norm-enforcing leaders, high threat: $M = 5.96$, $SD = 0.91$, 95% CI [5.75, 6.16]; low threat: $M = 4.95$, $SD = 1.38$, 95% CI [4.74, 5.15], $F(250) = 47.23$, $p < .001$, $\eta_p^2 = .16$. We then explored whether desire for tightness and norm-enforcing leaders mediate the effect of threat on leader position selection (serial mediation; PROCESS, Model 6, 10,000 iterations). The model we estimated included 3 indirect effects, as illustrated in Figure 1. The first indirect effect through Desire for Tightness (blue arrows) was not significant, $b = -0.09$, $SE = .12$, 95% CI [-.33, 0.14]. The second indirect effect through Desire for Norm-Enforcing Leaders (green arrows) was significant, $b = 0.11$, $SE = .06$, 95% CI [.01, 0.25]. The third indirect effect through Desire for Tightness and Desire for Norm-Enforcing Leaders in sequence (red arrows) was significant, $b = 0.10$, $SE = .06$, 95% CI [.01, 0.23]. As expected, the direct effect of Threat on Leader Position (black arrow) ceased to be significant, $b = 0.37$, $SE = .25$, $t(197) = 1.47$, $p = .14$, 95% CI [-0.12, 0.87]. These results indicate that the effect of threat on leader's position is fully mediated by desire for tightness and norm-enforcing leaders.

Discussion

Study 4 provided causal evidence that threat increased desire for tightness and norm-enforcing leaders, which in turn increased individuals' representation of leaders at the back of the group. Our findings therefore replicate the results of Menon et al.'s Study 3 and extend them in an important way: Our findings tie together the results of all previous studies by providing evidence for the role of desire for tightness and norm-enforcing leaders in mediating the link between threat and leaders' position. The mediation results further corroborate that cultural tightness is the key cultural dimension that drives cultural variability in mental representations of leadership.






Although Study 4 provided evidence for the mediating mechanisms that carry the effect of threat on leaders' position, the cross-sectional measurement of mediating and outcome variables might have introduced endogeneity issues (Bliese et al., 2020). Study 5 thus manipulated the mediating process of desired tightness to explore whether it yields a similar effect to threat in an experimental design that eliminates endogeneity. Moreover, all previous studies examined leaders' spatial position in groups that were on the move, which limits the application of findings to nonsedentary contexts that are less prevalent in modern societies. Accordingly, Study 5 aimed to generalize the findings to a sedentary context omnipresent in modern societies, namely, office space.

Study 5: Desire for Tightness and Leader's Position

Study 5 examined whether desired tightness would influence individuals' preference for leaders' position in an office space. Study 5 was preregistered: <https://aspredicted.org/blind.php?x=k5nt99>.

Figure 8

Visual Scenarios Used in the High Threat (Left) and Low Threat (Right) Conditions in Study 4

High Threat Condition	Low Threat Condition
<p>(a) This group is hiking in the woods. The hike is known to be long and difficult. The group is unaware of what they may encounter along the way, because they have never hiked in this area before. Furthermore, the group is uncertain whether they have enough resources (food, water) till the end of the hike. All these conditions make it a very dangerous hike.</p>	<p>(a') This group is hiking in the woods. The hike is known to be long and easy. The group is well aware of what they may encounter along the way, because they have hiked in this area before. Furthermore, the group is certain that they have enough resources (food, water) till the end of the hike. All these conditions make it a very safe hike.</p>
	
<p>(b) The local wildlife includes animals that can pose a serious threat to humans, such as mountain lions. Mountain lions have attacked humans several times in the past, because they consider this area to be their territory.</p>	<p>(b') The local wildlife includes animals that pose no serious threat to humans, such as feral cats. Feral cats usually run away from humans and have never attacked any humans, because they are afraid of humans.</p>
	
<p>(c) The hikers are now entering the mountain lion territory. Mountain lions can be anywhere. They can approach humans from any direction.</p>	<p>(c') The hikers are now entering the feral cat territory. Feral cats can be anywhere. They can run into humans from any direction.</p>
	

Note. The image on the top row was also used to measure leader's spatial position in Study 5. See the online article for the color version of this figure.

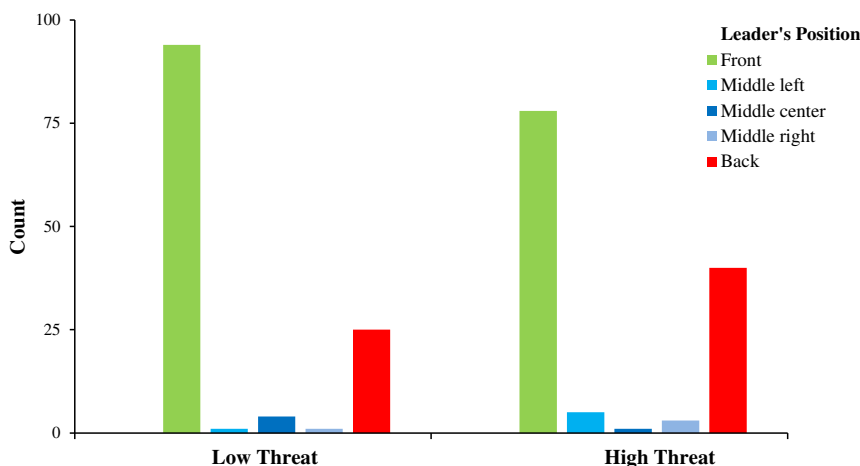
Method

Participants

The power analysis for Study 5 was based on the observed effect size of Studies 1A and 3 by Menon et al. (2010), which

have a similar design to our Studies 2, 4, and 5. The power analysis indicated that we need 195 participants. We therefore recruited 200 American citizens from Prolific to account for possible exclusions. We excluded one participant from the analyses who requested their data not be analyzed. The final sample

Figure 9
Leader's Position Selection as a Function of Threat in Study 4



Note. See the online article for the color version of this figure.

was 199 participants ($M_{\text{age}} = 33.45$, $SD_{\text{age}} = 12.46$, 54.3% women, 43.2% men, 2.5% other).

Materials and Procedure

Participants were randomly assigned to the desired tightness or desired looseness condition. They were presented with a visual scenario of a 3-member work team that was working for a large telecom company and had to complete a task that was critical for its continuity. In the [desired tightness/desired looseness] condition, participants read:

The team's project requires [following established rules and procedures/innovation and out-of-the-box thinking]. The team should be ready to [follow/challenge] all the rules. This means that all team members have to be as [meticulous and methodical/creative and imaginative] as they can. Thus, the team should not [skip over instructions/be afraid to get off the beaten track]. This way of working has ensured team success in the past.

Participants were then shown the layout of the team's office, which depicted three desks lined up in a room. To measure leader's spatial position, we asked participants to indicate the desk of the person in charge of the team (see Figure 10). Next, we asked participants to motivate their answer in an open-ended question. We then checked the manipulation of desired tightness using the same measure as in Study 4, which was adjusted to fit the context of this study (e.g., "It would be important that this work team 1 = *have few rules* vs. 7 = *have many rules*"; $\alpha = .92$). Finally, we asked participants whether we should include their data in the analyses using the same procedure we used in Study 3 (Meade & Craig, 2012).

Results

Participants in the desired tightness condition, $M = 6.08$, $SD = 1.72$, 95% CI [5.85, 6.31], reported greater perceived need for tightness than participants in the desired looseness condition, $M = 3.54$, $SD = 1.35$, 95% CI [3.31, 3.77], $F(1, 197) = 238.35$,

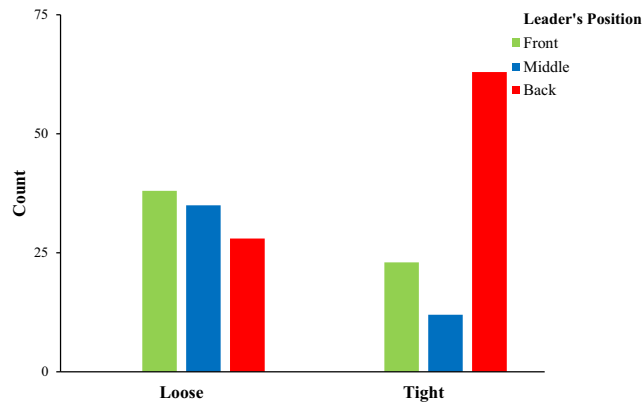
$p < .001$, $\eta_p^2 = .55$, which verifies that the desired tightness manipulation was successful. We then cross-tabulated desired tightness and leader position to obtain the frequencies and proportions of participants' responses across conditions (see Table 4). A logistic regression analysis indicated that the spatial precedence hypothesis was not supported, as participants were less likely to select a leader in the front (30.7%) than back position (45.7%), $b = 0.40$, $SE = 0.17$, Wald (1) = 5.84, $p = .016$. However, there was evidence for the expected effect of desired tightness on participants' choice of the leader's position, $b = 1.31$, $SE = 0.35$, Wald (1) = 14.20, $p < .001$. Odds ratio analysis indicated that, when comparing the desired tightness to the desired looseness condition, participants were 3.72 times, 95% CI [1.88, 7.36], more likely to represent the leader's desk at the back versus front side of the office (see Figure 11).

Figure 10
Image Used to Measure Leader's Spatial Position in Study 5



Note. See the online article for the color version of this figure.

Figure 11
Leader's Position Selection as a Function of Desired Tightness in Study 5



Note. See the online article for the color version of this figure.

Discussion

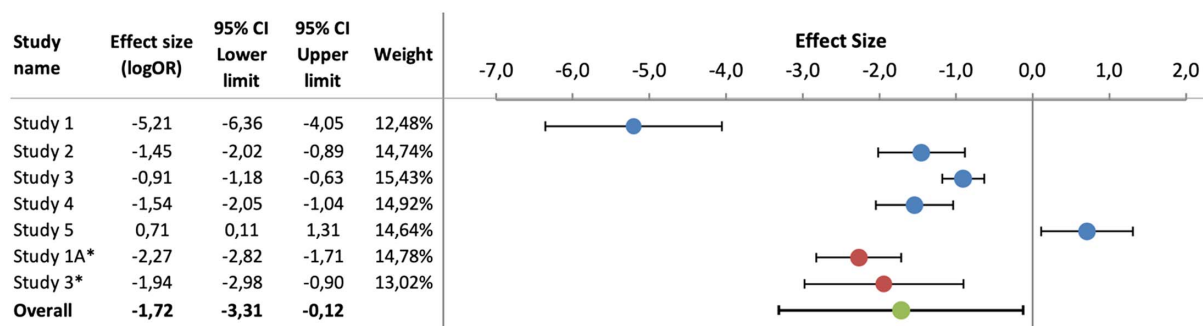
Study 5 manipulated desire for tightness to establish its causal effect on leader's position in the context of an organization's office space. These results prove that threat and desired tightness yield similar effects on leaders' position, thereby corroborating the link among threat, tightness, and representation of leaders at the back. Furthermore, Study 5 extends previous findings to an everyday, sedentary context, which demonstrates the breadth of the findings' applications to contexts that range from natural and urban environments to the military and the workplace. However, the spatial precedence effect was not replicated, which may be due to the context of the study. Participants' responses to the open-ended question indicated that the organizational context might have evoked privacy concerns, since having a person sitting right behind another would allow that person to watch over another's screen. Future replications of this study should consider this limitation.

Meta-Analysis of Original and Replication Studies

Even though our studies have largely replicated the findings of Menon et al. (2010) and have supported the hypotheses, we carried out two meta-analyses that synthesized findings across original and replication studies to provide more reliable estimates of the spatial precedence and moderation effects. We used the log of the odds ratios (logOR) as effect size estimates because they could be computed in all studies and their interpretation is more intuitive. A logOR of zero indicates a null effect, and values below and above zero indicate negative and positive effects, respectively. In our Study 1, which used a multilevel design, we estimated the effect size based on the average sample size per country and reversed the sign of the coefficients, so we could generate an effect that is comparable to all other studies. In our Study 3, we combined the data from the low threat condition and the low-threat-and-negative-affect condition to contrast them with the high threat condition, so we could generate only one effect size from the same sample (Raudenbush & Bryk, 2002). We used a random-effects approach because of the variety of methodologies used across studies. Meta-analysis was performed using Meta-Essentials software (Suurmond et al., 2017).

The meta-analytic results are presented in two forest plots that depict both the individual effects observed in each study and the overall effects estimated across studies. The first forest plot synthesizes the spatial precedence effect (Figure 12) and the second the moderation effect (Figure 13). The individual effects are represented with a blue circle (replication studies) or a red circle (original studies), and the overall effects are represented with a green circle. For the spatial precedence effect, the logORs express the difference between participants' choice of the front versus back figure across conditions. For the moderation effect, the logORs express the difference between participants' choice of the front versus back figure when comparing the high threat/high tightness to the low threat/low tightness conditions. The right part of the forest plots graphically presents these effects with their 95% confidence intervals relative to a reference line set at 0. When the confidence intervals of an effect fall on the left side of the reference line, participants were relatively more likely to select the front over the

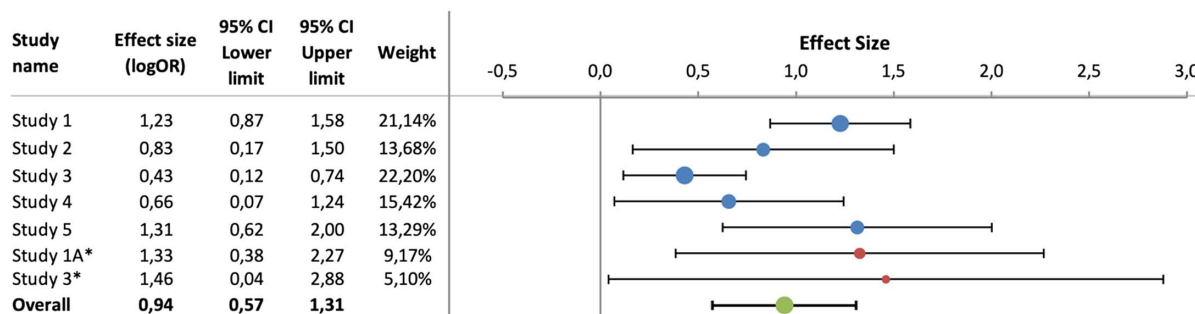
Figure 12
Meta-Analysis of the Spatial Precedence Effect



Note. Effect sizes are the log of the odds ratios. CI stands for confidence interval. An asterisk (*) indicates the original studies by Menon et al. (2010). Blue and red circles represent effects of individual studies, and the green circle represents the overall effect. See the online article for the color version of this figure.

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Figure 13
Meta-Analysis of the Moderation Effect



Note. Effect sizes are the log of the odds ratios. CI stands for confidence interval. An asterisk (*) indicates the original studies by Menon et al. (2010). Blue and red circles represent effects of individual studies, and the green circle represents the overall effect. See the online article for the color version of this figure.

back figure as leader; when they fall on the right side of the reference line participants were relatively more likely to select the back over the front figure as leader; and when they fall in between, there was no significant difference in participants' choice for the front or back figure.

With regard to the spatial precedence effect, the test of heterogeneity showed that the effect significantly varied across studies, $Q(6) = 110.19$, $p < .001$, $I^2 = 94.56\%$. All studies showed a negative effect, with the exception of one study that showed a positive effect. The overall statistics should therefore be interpreted with caution. The overall statistics indicate that participants across conditions, were more likely to select a front rather than back figure as leader, $\log OR = -1.72$, $SE = 0.65$, $Z = -2.64$, $p = .008$, 95% CI $[-3.31, -0.12]$, which corresponds to an OR of 0.18, 95% CI $[0.04, 0.89]$, and a probability of 0.15, 95% CI $[0.04, 0.47]$: Across studies and across conditions, the probability of choosing a leader at the back of the group was 15% and in the front was 85%, indicating that the size of the spatial precedence effect was large.

With regard to the moderation effect, the test of heterogeneity again showed significant variation across studies, $Q(6) = 15.13$, $p = .019$, $I^2 = 60.35\%$. The direction of the effects, however, was homogeneous, which allows us to interpret the overall statistics. The overall statistics showed that, in comparison to low threat or low tightness conditions, participants under high threat or high tightness conditions are relatively more likely to select a figure at the back versus in front of the group as leader, $\log OR = 0.94$, $SE = 0.15$, $Z = 6.27$, $p < .001$, 95% CI $[0.57, 1.31]$, which corresponds to an OR of 2.56, 95% CI $[1.77, 3.71]$: Across studies, participants in high threat or high tightness conditions were 2.56 times more likely to select a leader at the back versus in the front as compared to participants in low threat or low tightness conditions, indicating that the size of the moderation effect was small to medium.

In sum, the meta-analytic evidence supports both the spatial precedence and moderation hypotheses and shows significant variation in the effect sizes of different studies, which also reflects their different methodologies. The independent variable was theoretically consistent across studies, yet always adjusted to the purpose of the study: Two of the studies included a cross-cultural sample (our Study 1 and Study 1A by Menon et al.), three studies manipulated

high and low levels of threat (our Studies 2, 3, and 4), one study manipulated threat and opportunity (Study 3 by Menon et al.), and one study manipulated high and low levels of tightness (our Studies 5). The dependent variable was similar across studies as participants would always be asked to indicate the leader, yet the measure was always adjusted to different contexts that widely varied (e.g., nature, organization, urban environment, battlefield). Given all the variations across studies, it is noteworthy that the observed effects across our studies and Menon et al.'s studies provide largely consistent evidence.

General Discussion

Leadership profoundly shapes our capacity to organize in groups, cooperate, and ultimately survive. It is therefore not surprising that some form of leadership has been documented in all ethnographically studied cultures (Brown, 1991). The nonverbal communication of leadership, crucial to the formation of hierarchical relations, has been studied across species. Menon et al. (2010) first showed that the concept of human leadership is grounded in spatial representations that are shaped by our cultural environments. The goal of our research was to replicate and extend Menon et al.'s findings across five studies and 25 countries. Our results jointly suggest that spatial precedence, or being in front of a group, is universally associated with leadership, thereby revealing a general principle across human and nonhuman species. However, this tendency of representing leaders ahead of groups changes when the cultural environment is replete with situational or historical threats (i.e., tightness): Under these conditions individuals are relatively more likely to represent leaders in rearward rather than frontal spatial positions. A major contribution of our research is that we unraveled the cultural dimension underlying these contextual differences: Cultural tightness increased individuals' relative tendency to represent leaders at the back rather than frontal spatial positions. In addition, our research formally tested the spatial precedence hypothesis and provided evidence consistent with anthropological theories and empirical evidence from ethological and linguistics studies.

Theoretical Implications

Our research enhances understanding of the evolution and cross-cultural patterning of leadership. First, our findings contribute to theory development in the field of grounded cognition. We show that leadership is universally represented on a horizontal spatial dimension as being in front of others. This finding complements research that examined other hierarchy-related concepts, like power, which is represented on a vertical spatial dimension as being on top. Apparently, hierarchy-related concepts can be understood through alternative physical dimensions. The front-back image schema we demonstrated coexists with other metaphors for hierarchy relations, wherein each metaphor only partially captures the concept (Lakoff & Johnson, 1999). The metaphor that will be activated may depend on the salient properties of the hierarchical relation or the context where the hierarchical relation is considered. In our studies we emphasized typical leader properties in a team framework, such as being in charge, making decisions, and distributing resources. This might have triggered participants to think of leadership as instrumental to group goal attainment in a context that required monitoring the group from the back in the face of threat or showing the way from the front when no threat was present. Other studies that made salient the properties of magnitude and strength activated representations of power on the vertical spatial dimension (e.g., Schubert, 2005). Vertical spatial cues can also be integrated with horizontal spatial cues to inform leadership judgments. For instance, one study showed that the photo of a company's Chief Executive Office (CEO) is more likely to appear on the upper-left corner of the company's website—a context where information is organized based on visibility (Paladino et al., 2017). Seen together, these findings point to a multimodal representation of hierarchy constructs, where individuals represent hierarchical relations in a dynamic way, with the situation calling upon a particular bodily state or physical dimension that is meaningful in the given situation (Barsalou, 1999, 2008).

The grounding of mental representations is thus better understood by jointly considering situational factors and prevalent cultural norms that shape the expression of conceptual metaphors. This approach is also consistent with theories of situated grounded cognition advocating for an integrated and embedded perspective on body–mind linkages (Cohen et al., 2009; Cohen & Leung, 2009; Leung et al., 2011). At the same time, our findings extend previous research on situated grounded cognition by proposing an alternative way of studying variability in mental representations. Although previous research would mostly focus on cross-cultural comparisons as a way to demonstrate how culture may influence individuals' mental representations, our research examined and demonstrated both within and between culture variance. This methodological approach can offer a deeper insight into the underlying processes that account for both forms of variance (Leung & Cohen, 2011). In our study, for instance, both within and between culture variance was explained by the same underlying principle: The need to coordinate under threatening cultural ecologies increased individuals' tendency to represent leaders in a position that allows leaders to enforce the rules.

Furthermore, the finding that differences in cultural tightness may cause variability in spatial order cues to leadership complements previous studies showing that spatial magnitude cues differ in Western and Eastern countries, as a result of valued leadership qualities. For instance, individuals who assumed an expansive body

posture by putting their feet on a table rather than on the floor were seen as more powerful in the U.S. and the Netherlands, yet as less powerful in China, where this particular expansive posture may be inconsistent with the norm of modesty valued in East Asian cultures (Park et al., 2013; Stamkou et al., 2019; Van Kleef et al., 2011). We similarly found that prevalent cultural norms of keeping to the rules and maintaining order as reflected in greater cultural tightness, shape the mental representation of leadership as well as the kind of leader people desire under threat. Thus, different cultural ecologies offer different bodily kinetic experiences that bear substantial cultural meanings, which in turn shape individuals' mental representations of fundamental concepts.

Practical Implications

Our research clearly shows that spatial order metaphors for navigating hierarchy are shaped by culture and related ecological conditions. This not only broadens our theoretical understanding of the dynamics of hierarchy but also has important practical implications. Spatial metaphors do not merely exist for the sake of mental representation but also for action. Metaphors build directly on the needs that people seek to materialize in their social worlds (IJzerman & Koole, 2011; Wisman & Koole, 2003), and these needs vary depending on the cultural context. Accordingly, spatial order metaphors can be enacted by leaders as a way of adjusting to the demands of destabilizing ecological factors (e.g., threat) and cultural imperatives of conforming to the rules. This is consistent with our finding that ecological threat instigated the desire for a tightly regulated team and a norm-enforcing leader, which in turn carried the effect of threat on people's mental representation of the leader at the back of the group. Similarly, other cross-cultural studies show that in organizations that are under financial threat, leaders exercise more control, become more directive, and want to keep an eye on all matters (Scully et al., 1994; Stoker et al., 2019). Threat in organizations thus urges leaders to tighten up the rules and monitor others. Likewise, a rearward spatial position increases the leader's viewshed and ability to monitor others' behavior. Being at the back can therefore be seen as a strategic position to supervise others to manage threats. Our research thus shows how leader's spatial position can serve as a subtle yet strategic cue to leadership by activating leadership prototypes that are considered adaptive in certain cultural ecologies.

The implications also extend to understanding diversity and leadership. Hierarchies permeate human relations and individuals across cultures use spatial metaphors to make sense of hierarchies. Spatial metaphors, together with other mental representations of rank, are important tools in navigating, creating, consolidating, and challenging hierarchical relations. The expression or reification of these metaphors in people's nonverbal behavior (e.g., where in the room they will seat, how much space they will consume) helps people to signal and assert their rank, to infer others' desire to climb the ladder or to thwart the hierarchy status quo (Fiske, 2004). Although *static* spatial cues, like one's bodily size or height, provide one route through which individuals can gain higher rank, the current research highlight another route to leadership attainment through *dynamic* spatial cues, like one's precedence or order in space. Spatial order cues can therefore be used by and benefit individuals who may be systematically excluded from leadership positions, because they lack static spatial attributes associated with

higher rank, such as physical height (Judge & Cable, 2004; Young & French, 1998). Understanding whether dynamic cues can be effectively used to enhance the rank of disadvantaged individuals is essential in a world where inequality is often fueled by fixed sociodemographic characteristics, like gender and race (Rucker et al., 2018).

Being able to diagnose the metaphors from subtle behavioral cues and manage their meaning offers an advantage to people who operate in complex multicultural societies, and in intercultural contexts—such as in foreign relations, global organizations, and the military—where differences in spatial metaphors for leadership may lead to cultural conflict (Homan et al., 2020). For instance, in tight cultures, people may expect their leaders to take a “backseat driver” role to monitor group members, a role that can be symbolically evoked through physical space (Pfeffer, 1981). This behavior, however, may seem puzzling to individuals in loose cultures, who expect their leaders to lead the way and allow group members to break the mold. Leaders who behave in ways that do not conform to the cultural expectations about a leader’s spatial position could be perceived as less prototypical, which in turn may reduce their effectiveness (Giessner & van Knippenberg, 2008; van Knippenberg & Hogg, 2003). Leaders’ nonverbal behavior can therefore lead to social and financial benefits or deficits depending on whether or not behavioral cues are interpreted and managed in culturally congruent ways (Phillips & Lord, 1986). Understanding these cultural dynamics can enhance cross-cultural empathy, which is a pressing issue in an increasingly polarized world that has been differentially exposed to ecological and historical threats.

Limitations and Future Directions

Some of the images we used to measure leaders’ spatial position were abstract (Study 1), which served the purpose of cross-cultural equivalence, while other images were contextualized (Studies 2–5), which served the goal of simulating real-world situations. This research material thus provided for both cross-cultural comparability and maximum experimental control. Given the focus of our research on the cognitive aspect of the mental representation of leadership, we presented participants with images of teams on the screen or paper, following the example of Menon et al. (2010) as well as previous research on conceptual metaphors and image schemas (e.g., Giessner & Schubert, 2019; Hegarty et al., 2010; Schwartz et al., 1982). This mode of presentation capitalized on people’s ability to deduce real-world spatial arrangements from two-dimensional images (Biederman, 1987). Future research could investigate the behavioral aspect of individuals’ mental representation of leadership in naturally occurring environments that offer greater ecological validity. Studies that examine, for instance, how existing leaders position themselves in different contexts could provide an alternative test of our idea. It is noteworthy, however, that experimental control in real-world settings would be limited because spatial order cues exist in tandem with spatial magnitude cues (e.g., bodily size and posture), other nonverbal behaviors (e.g., vocal tone and facial expressions), and sociodemographic characteristics (e.g., gender and race), that are all associated with leadership in different ways. These concerns highlight the value of triangulating different methods when studying nonverbal cues to leadership.

Another limitation of our research has to do with representing a male-centered version of leadership. Four of our Studies (2, 3, 4, and 5) depicted only male team members. We decided to use same-sex team members across studies to avoid confounding spatial precedence effects with gender stereotypes which favor males as leaders (Bailey et al., 2019; Eagly & Karau, 2002), or cognitive biases about the order of sexes in graphs. Our Study 1 and Study 1A by Menon et al. (2010), which used human-like figures of no discernible gender, provides some support that the observed effects may not be gender-specific. However, it still remains to be tested whether the main effect of spatial precedence on perceptions of leadership would generalize among female figures. Another interesting possibility is that the figure’s gender would interact with ecological threat. Research on the glass cliff phenomenon suggests that women, who are seen as more self-sacrificial, are preferred more as leaders in times of organizational decline, which disturbs order and introduces existential threat (Morgenroth et al., 2020; Ryan et al., 2011; Ryan & Haslam, 2007). It then follows that women leaders would be more likely to be mentally represented at the back of a group that faces situational threats. Future research could investigate this question.

Conclusion

Metaphors enable humans to map abstract concepts that cannot be perceived by bodily experiences to concrete conceptual fields that are directly associated with the sensory–motor system of the body (Lakoff & Johnson, 1999). Space, a concrete entity in our physical worlds, substantiates abstract concepts, like leadership in our mental worlds. It is striking how the metaphor of leadership as spatial precedence has survived through the ages and across species. This indicates that hierarchical relations might have included basic physical experiences that have remained similar over time, where leaders have often been placed in the forefront and followers behind. At the same time, hierarchical relations cannot be considered outside their cultural context and related ecological conditions, which shape the meaning of leadership and sometimes favor leaders at the back.

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