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Emotional cues to group hierarchy: Inferences about dominance- versus prestige-based hierarchies from members' emotional expressions

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ABSTRACT

Dominance and prestige are both strategies to attain rank. They are differentially effective depending on whether the group's hierarchy is based primarily on dominance or prestige. Insight into the nature of the group's hierarchy is therefore essential for upward mobility. But how do people obtain such insight? In five studies (two pre-registered; combined $N = 2470$), we investigated whether people use group members' emotional expressions to draw inferences about the degree to which a group's hierarchy is dominance- or prestige-based. We distinguished among three theoretical accounts: (1) a valence account, which posits that negative emotions convey that hierarchies are more dominance- and less prestige-based than positive emotions; (2) a social engagement account, which holds that socially engaging emotions convey that hierarchies are more prestige- and less dominance-based than socially disengaging emotions; and (3) a discrete-emotions account, which suggests that only a few specific emotions convey information about the predominant hierarchy type. We tested these predictions from the perspective of group members and outside observers, reporting experimental evidence on the effects of five emotional expressions (happy, proud, neutral, sad, angry). Our findings support a combined valence and social engagement account: Expressions of positive emotions signal a more prestige- and less dominance-based hierarchy than negative emotions, and among emotions of similar valence, expressions of socially engaging emotions signal a more prestige- and less dominance-based hierarchy than disengaging emotions. Extending the work on affective processes in hierarchy, we conclude that emotional expressions provide important cues about how rank is typically attained in groups.

Hierarchy, the vertical ordering of group members, is a ubiquitous feature of social groups (Magee & Galinsky, 2008). Ranging from the god-like Pharaohs in ancient Egypt to the outcast Dalits in present-day India, people's positions in social hierarchies profoundly shape their lives (Anderson & Kilduff, 2009). Compared to their lower-ranking counterparts, those with higher rank enjoy a variety of benefits, such as privileged access to and control over resources (Keltner et al., 2003), behavioural freedom (Galinsky et al., 2003), deference of and influence over others (Cheng et al., 2013), and better health and well-being (Fournier, 2020). To gain rank, group members may employ at least one of two strategies: intimidating others to instill compliance, known as the *dominance* strategy, or showing superior skill to elicit respect, known as the *prestige* strategy (Cheng et al., 2013; Henrich & Gil-White, 2001). However, these strategies are not equally prevalent and effective across all groups. Instead, groups differ in the degree to which their hierarchies are predominantly dominance- or prestige-based (de Waal-Andrews et al., 2015; Van Vugt et al., 2008). Thus, to climb the hierarchy, group members need to use the appropriate strategy in their group. But how do group members know which type of hierarchy exists in their groups? Building on research showing that emotional expressions convey information about power and status (Hareli et al., 2009; Keltner & Haidt, 1999; Lange & Crusius, 2015; Tiedens, 2001; Witkower et al., 2020) as well as group-level properties (Adler et al., 2022; Heerdink et al., 2018; Homan et al., 2016; Rothman & Magee, 2016; Wolf et al., 2023), we propose that emotional expressions are used as cues to the type of hierarchy in a group.

1. The dominance-prestige framework of human hierarchies

The dominance and prestige strategies for attaining rank consist of distinct cognitive, affective, and behavioural devices that any group member can use (more or less successfully) to improve their ranking

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relative to other members, and that involves specific dynamics between the higher- and lower-positioned group members (Cheng et al., 2013; de Waal-Andrews et al., 2015; Henrich & Gil-White, 2001). Dominance and prestige hierarchies originate in interactions between group members and develop dynamically and organically. As such, they can be distinguished from hierarchies that are based on formalized positions and derive from institutional control, such as a leadership positions in an organization or society (Cheng et al., 2013).[1]

In dominance-based hierarchies, rank is *taken* by group members by behaving aggressively and authoritatively, which includes acts of derogation, social exclusion, and manipulation. Lower-ranking individuals avoid higher-ranking individuals out of fear, and defer in order to protect and safeguard themselves (Cheng et al., 2013; de Waal-Andrews et al., 2015; Henrich & Gil-White, 2001). Dominance-based hierarchies are often seen in non-human animals, for instance among chimpanzees (Maner & Case, 2016; Noë et al., 1980), but can also be readily found in human groups. For instance, the bullying of other children is understood as a dominance strategy to obtaining social rank (Sijtsema et al., 2009). Although the behaviours associated with dominance are often considered undesirable, dominance has been found to be an effective strategy for attaining and maintaining rank in real-world groups (McClanahan et al., 2022). Dominant leaders are especially likely to emerge in times of crisis, such as economic uncertainty, or intergroup conflict (Kakkar & Sivanathan, 2017; Laustsen & Petersen, 2017).

In prestige-based hierarchies, in contrast, rank is afforded or granted by other group members and cannot be taken. It is based on demonstrating one's social worth, superior expertise, and competence, for instance by displaying knowledge, working hard, and helping others. Lower-positioned individuals are motivated to defer in exchange for chances to learn and copy (Cheng et al., 2013; de Waal-Andrews et al., 2015; Henrich & Gil-White, 2001). Because of their intimate connection with cultural learning, prestige hierarchies are theorized to be uniquely human (Henrich & Gil-White, 2001). For instance, in the Amazonian Tsimane tribe, individuals with greater fitness-enhancing ethnomedical plant knowledge enjoy greater prestige (Reyes-Garcia et al., 2008). Individuals with more prestige are indeed more likely to acquire and maintain higher rank in task groups (McClanahan et al., 2022), and children as young as four years old pay more attention to a prestigious model, underscoring the role of prestige in social learning (Chudek et al., 2012).

Although groups may possess elements of both dominance and prestige hierarchies simultaneously (Cheng et al., 2013; de Waal-Andrews et al., 2015; McClanahan et al., 2022), groups differ in the degree to which dominance or prestige is emphasized as a viable strategy for attaining rank. As an extreme example, Cheng et al. (2010) suggest that groups such as prison populations may operate solely on dominance, rendering prestige-related behaviours a futile strategy to attain rank (Cheng et al., 2010). Conversely, Henrich and Gil-White (2001) describe the Malaysian Semai society where dominance-related behaviours are suppressed, and hence their hierarchy may be almost exclusively prestige-based. Such differences appear to coincide with the emphasis groups put on cooperation (which is more congruent with a prestige strategy) versus competition (which is more congruent with a dominance strategy; Halevy et al., 2012; Spisak et al., 2012; Van Kleef et al., 2021). The (to our knowledge) only empirical demonstration that individuals indeed perceive differences in the predominant hierarchy type in groups is provided by de Waal-Andrews et al. (2015); yet, their evidence leaves the origins of these perceptions unexplained. Naturally, being able to infer differences in the most viable strategy for attaining rank would be adaptive for people looking to ascend the hierarchy and access the commensurate benefits. In this article, we propose that emotional expressions provide important cues about the degree to which a group's hierarchy is dominance and prestige-based.

[1] In the literature on the dominance-prestige framework, the term *social status* is used to denote the outcome of these informal strategies, and *power* for the formal ranking of group members (Cheng et al., 2013). Other scholars, however, argue that power is specifically about control over valued resources whereas status is about respect in the eyes of others (e.g., Magee & Galinsky, 2008). To avoid conceptual confusion, we use the more neutral term *rank* to refer to the outcome of dominance and prestige processes (see Körner et al., 2025 for an in-depth discussion of relations between these concepts).

2. Emotional expressions and hierarchy types

Social-functional approaches to emotion propose that emotions help individuals solve challenges in the social world (Keltner & Haidt, 1999; Parkinson, 1996; Van Kleef, 2016). These functions are fulfilled through both the experience of emotions – which for instance provide feedback on the fulfilment of motives, and regulate one's behaviour (e.g., Frijda, 1986; Lazarus, 1991) – and the expression of emotions, which exert influence on other's affect, cognition, and behaviour (Van Kleef et al., 2011). Given the fitness benefits afforded by higher rank (at least in men, see Barthold et al., 2012; von Rueden et al., 2011), attaining rank has evolved as a fundamental human motive (Anderson et al., 2015), and affective processes likely contribute to the fulfilment of this motive. One such rank-related social function of emotions is to "help[ing] individuals define and negotiate group-related roles and statuses" (Keltner & Haidt, 1999, p. 512; see also Cheng et al., 2010; Fischer & Manstead, 2008, 2016). A growing body of research documents this affective side of rank attainment. For instance, at the intra-individual level, higher rank is associated with experiencing more positive emotions and less anger, and experiences of pride and sadness respond to (perceived) changes in rank (Berdahl & Martorana, 2006; Keltner et al., 2003; Tracy et al., 2020; Witkower et al., 2020). At the inter-personal level, expressions of emotions such as anger, sadness, and pride are used as information about the expressor's rank (e.g., Brescoll, 2016; Brescoll & Uhlmann, 2008; Hareli et al., 2009; Lange & Boecker, 2019; Tiedens, 2001; Tiedens et al., 2000).

Building on this work documenting the rank-related functions of emotional expressions at the interpersonal level, our primary goal was to establish whether observers also infer the predominant hierarchy type in a group based on the emotions that are expressed in the group. Importantly, we do not propose that links between emotional expressions and hierarchy exist only through their rank-regulating functions. Instead, we consider emotional expressions as the outward manifestation of *emotional cultures* or *expression norms* (Adler et al., 2022; Barsade & O'Neill, 2014; Wolf et al., 2023), reflecting the specific (types of) emotion that are common and appropriate for team members to express, whether in relation to each other (e.g., in the service of rank signalling and negotiation, but also in day-to-day interaction or influence situations), or toward the outside world. Starting from the emotion literature, we developed three theoretical perspectives (with increasing specificity) that each suggest different hypotheses about the hierarchy type that observes may infer from group members' emotional expressions: a valence account, a social engagement account, and a discrete-emotions account. Our secondary aim was to distinguish between these accounts.

2.1. Valence account

The first theoretical account focuses on valence, which refers to the pleasantness or positivity of the emotional experience, and which is commonly considered the primary dimension of core affect (with activation or arousal being the other; Russell, 1980; Russell & Barrett, 1999). Broadly speaking, higher rank is associated with experiencing and expressing more positive emotions than lower rank (Berdahl & Martorana, 2006; Keltner et al., 2003; for a review, see Van Kleef & Lange, 2020). Because dominance-based hierarchies tend to be steeper than prestige-based hierarchies (Maner & Case, 2016), the experience and expression of positive emotions may be limited to the *happy few* in a dominance-based hierarchy, whereas it may occur in more group

members in a prestige-based hierarchy. Furthermore, emotions associated with dominance-based hierarchies tend to have more negative valence (e.g., fear, Cheng et al., 2010; malicious envy, Crusius & Lange, 2016; Hasty et al., 2024) than emotions associated with prestige-based hierarchies (e.g., admiration, Cheng et al., 2013), suggesting that membership in a prestige-based hierarchy may be a more positive experience overall (see also Wen & Ma, 2023). Thus, if group members express negative emotions, this may convey that their group's hierarchy is predominantly dominance-based, whereas positive emotional expressions may convey that a hierarchy is predominantly prestige-based.

2.2. Social engagement account

The second theoretical account builds on a different emotional dimension, which originates in cross-cultural research on emotion: the degree to which emotions are socially engaging or disengaging. Socially engaging emotions are emotions that reflect the salience of duties to the group, and concerns for interdependence,[2] connectedness, and relational harmony (Kitayama et al., 2000, 2006). Socially disengaging emotions, in contrast, are emotions that emphasize the independence of the self, and reflect concerns for autonomy and personal achievement (Kitayama et al., 2000, 2006). Importantly, the engagement dimension is orthogonal to valence (Kitayama et al., 2000; Rothman & Magee, 2016), which means that socially engaging emotions can be positive (e.g., respect, gratitude) as well as negative (e.g., guilt, sadness). Similarly, socially disengaging emotions can be both positive (e.g., pride) and negative (e.g., anger; Gordon et al., 2012; Horberg et al., 2013; Kitayama et al., 2000, 2006). Rothman and Magee (2016) reported initial evidence that this dimension has important consequences for inferences drawn from emotional expressions, and that it may work in tandem with valence. They showed how (managers') impressions of team cohesiveness and conflict are based on both valence and engagement. Generally speaking, expressions of positive emotions convey a tighter-knit and more cooperative group than expressions of negative emotion. Importantly, however, within clusters of emotions of similar valence, expressions of engaging emotions (e.g., sadness) convey greater cohesion than expressions of disengaging emotions (e.g., anger).

A range of findings suggests that dominance is associated with social disengagement, whereas prestige is associated with social engagement, and we propose that these associations extend to emotional expressions. Dominance-based hierarchies revolve around creating and maintaining (vertical) social distance, for instance to safeguard one's position (Maner & Case, 2016). Indeed, individuals who use a dominance strategy are likely to have socially disengaging traits including disagreeableness and narcissism (Cheng et al., 2010; Maner, 2017). Socially engaging emotions, on the other hand, fit prestige-based hierarchies because social proximity is conducive to social learning – key to the conferral of prestige. This desire for social connection is also apparent in the traits associated with the use of the prestige strategy, which include agreeableness and need for affiliation (Cheng et al., 2010). Finally, dominant leaders may prevent group members from bonding, thereby undermining cohesion, whereas prestigious leaders encourage good relations between group members (Case & Maner, 2014). Hence, this perspective suggests that expressions of socially disengaging emotions convey that the hierarchy is predominantly dominance-based, whereas expressions of socially engaging emotions convey that the hierarchy is predominantly prestige-based.

2.3. Discrete-emotions account

The third theoretical account proposes that only emotions that are central to either the dominance or the prestige strategy provide information about the group's hierarchy type. A comprehensive review of the literature identified nine distinct emotions relevant to social hierarchies (Witkower et al., 2020). Four of these emotions (sadness, contempt, disgust, shame) are not uniquely linked to either strategy for attaining rank, and may be relevant to both; two more emotions (pride, envy) have different *flavours* in different hierarchy types: authentic pride and benign envy in prestige-based hierarchies, and hubristic pride and malicious envy in dominance-based hierarchies (Lange & Crusius, 2015; Tracy et al., 2020). The final three emotions can be clearly linked to a specific hierarchy type and may therefore be the most important cues to the type of hierarchy in a group: anger, fear, and admiration. Henrich and Gil-White (2001) emphasized the elicitation of fear to achieve dominance, and elicitation of admiration to achieve prestige. Echoing this idea, current validated peer-rating scales of dominance and prestige (Cheng et al., 2010) include items such as: “I am afraid of him/her” (dominance) and “I respect and admire him/her” (prestige). The experience of fear may not be exclusive to subordinates, however. In dominance hierarchies, which are relatively unstable, high-ranking members need to be vigilant for attacks on their rank, suggesting a degree of anxiety, whereas in prestige hierarchies, which are relatively stable, they do not (Maner & Case, 2016; Stamkou et al., 2016). Furthermore, high-ranking individuals may try to retain their dominance through “outbursts of unpredictable anger (inducing stress in subordinates)” (Cheng et al., 2010, p. 338), and angry expressions have been found to convey dominance (Knutson, 1996) and high rank (Tiedens, 2001). Thus, anger and fear expressions are central to the dominance strategy (Witkower et al., 2020), and hence they may be the main cues to a dominance-based hierarchy. Conversely, admiration expressions may be the main cues to a more prestige-based hierarchy.

3. The present research

We conducted a series of five studies to test the general idea that emotional expressions convey information about the type of hierarchy in a group, and to progressively distinguish between the three theoretical accounts discussed above. Specifically, in Study 1, we asked participants to reflect on their experiences in a real-world group, and to report both on the type of hierarchy and the frequency of expression of specific emotions in this group. In Studies 2 to 5, we experimentally manipulated emotional expressions to study how these influence inferences about the type of hierarchy in the group. Our initial study included discrete emotions of varied valence and social engagement, and the four ensuing experimental studies tested increasingly specific hypotheses to distinguish between the three perspectives.

4. Study 1

In Study 1, we investigated relations between hierarchy type and the prevalence of six discrete emotional expressions in real-world groups, as reported by group members. The emotions were anger, fear, sadness, happiness, admiration, and pride. To provide initial insight into the viability of these three theoretical approaches, we selected these emotions to represent all four of the positive-engaging (happiness,[3] admiration), positive-disengaging (pride), negative-engaging (sadness) and negative-disengaging (anger) quadrants; as well as to include all emotions that are relevant to the discrete emotions account (admiration,

[2] The interdependence meant here is distinct from task (or structural) interdependence. It reflects a relative emphasis in self-construal, rather than the absence or presence of a contextual characteristic. Thus, it is possible for group members to emphasize their independence, even if the group members are structurally interdependent (e.g., due to a common goal).

[3] Although happiness is described as a ‘general positive emotion’, empirically it falls in the positive engaging emotions quadrant (Kitayama et al., 2000), which fits its affiliative function (Fridlund, 1991). Hence, we classify it as an engaging emotion.

anger, and fear). Note that prior literature allows for divergent interpretations about fear as being social disengaging (due to its associated avoidance motivation) as well as socially engaging (due to its affiliative function, e.g., Hammer & Marsh, 2015; Schachter, 1959), and hence we do not classify it in terms of social engagement. Furthermore, we prioritized emotions with well-established facial expressions, to be able to experimentally replicate our findings using both facial expression stimuli and verbal stimuli.

4.1. Method

The preregistration of this study can be found at https://osf.io/49xzd/.

4.1.1. Design and participants

Our correlational survey was completed by 397 English-speaking participants via Prolific Academic. We excluded 13 participants (3.3%) who had failed one or both of our attention checks (asking participants to write "Group" under 'other' among a list of sports at the beginning and to choose *never* on a 7-point scale halfway through the survey; Oppenheimer et al., 2009), leaving a sample of 196 men, 186 women, one non-binary, and one agender person (age $M = 31.89$, $SD = 9.84$, range = 18–69). Sample size was based on a-priori power analysis simulations (available on OSF), indicating that 400 participants would provide 80% power to detect a 0.20 difference between two overlapping correlations r_{XY} and r_{XZ}, given an intercorrelation of at least $r_{YZ} \geq 0.15$; or a 0.30 difference with small or negative intercorrelations ($r_{YZ} < 0.15$).

4.1.2. Materials and procedure

4.1.2.1. Group prompt. We instructed participants as follows: "Think about a group: (a) in which you are a member, (b) in which the members interact with each other on a regular basis, and (c) which represents your last group-based activity", and provided examples of relevant small groups (e.g., sports teams and study groups). Using a combination of open and closed questions, we asked participants to describe the group, how long they had been a member, how long the group has existed, their role in the group, the structure of the group, their own rank in the group, and the group's atmosphere. These questions were intended to help participants recollect a vivid and detailed mental image of their group.

4.1.2.2. Measuring emotional expression prevalence. We asked "How often do members express [emotion] within your group?" (1 = *never*, 7 = *all the time*) about each of the six emotions (i.e., anger, fear, sadness, happiness, admiration, and pride).

4.1.2.3. Measuring rank-specificity of emotional expressions. To explore whether any of the six expressions are specific to higher-ranking or lower-ranking group members, for each expression, we asked "Who would be most likely to express [emotion] within your group? (The midpoint of the scale would indicate that members ranking at the bottom and at top of the group structure are equally likely to express [emotion])" measured on a 7-point scale (*1 = members at the bottom of the group structure*, *7 = members at the top of the group structure*).

4.1.2.4. Measuring hierarchy type. We adapted items from de Waal-Andrews et al. (2015). The items "Higher positions are assertively taken by group members who have the ability or means to do so" and "Group members with lower rank go along with those with higher rank because they want to avoid repercussions" measured dominance-based hierarchy, $r(382) = 0.29$, $p < .001$. "Higher positions are willingly given to group members who are valued by the rest of the group" and "Group members with lower rank go along with those with high rank out of genuine respect" measured prestige-based hierarchy, $r(382) = 0.41$, $p < .001$.

4.2. Results

Participants chose groups with $Mdn = 11$ members that had existed for $Mdn = 5$ years, which participants had been a member of for $Mdn = 3$ years (all right-skewed). Measured on 7-point Likert scales, groups had moderately steep hierarchies ($M = 4.02$, $SD = 2.29$), which tended to be slightly more prestige-based ($M = 4.71$, $SD = 1.61$) than dominance-based ($M = 3.76$, $SD = 1.61$). Participants ranked themselves slightly above the average group member ($M = 4.43$, $SD = 1.61$). Groups had a very good atmosphere ($M = 6.39$, $SD = 0.92$), and negative expressions were reported to be less prevalent (fear $M = 2.41$, $SD = 1.50$; sadness $M = 2.88$; $SD = 1.57$; anger $M = 2.90$, $SD = 1.65$) than positive expressions (pride $M = 4.95$, $SD = 1.65$; admiration $M = 5.23$, $SD = 1.47$; happiness $M = 6.04$, $SD = 1.00$). Ratings spanned the full range of the 7-point scale for all measures except happy expressions, which ranged from 2 to 7. Thus, we had sufficient variance to test our hypotheses.

4.2.1. Expression prevalence in different hierarchy types

Fig. 1 presents point estimates and two-tailed 95% bootstrap confidence intervals (10,000 resamples) of the correlations between the frequency of the six emotion expressions, and hierarchy types (dominance and prestige). We tested our theoretical ideas by conducting targeted pairwise comparisons between correlations using the bootstrapping approach from Wilcox (2016; overlapping case), as implemented in the *bootcorci* package for R (version 0.0.0.9000 Rousselet et al., 2019), following their recommendation to use Spearman's correlations for robust results (10,000 resamples).

To test our core premise, that the prevalence of emotion expressions differs depending on a group's hierarchy type, we compared each emotion expression's correlation with ratings of dominance hierarchy to the same emotion expression's correlation with ratings of prestige hierarchy (six comparisons in total). Because all theoretical perspectives predict that anger and fear relate more to dominance than prestige, and admiration more to prestige than dominance, we used one-sided testing for anger, fear and admiration and two-sided testing for the remaining three emotions. We applied a Holm-Bonferroni correction (reported as $\tilde{p}$) to the resulting six p-values. Fear ($\Delta\rho = 0.19$, $\tilde{p} = 0.007$), anger ($\Delta\rho = 0.15$, $\tilde{p} = 0.029$), and sadness expression prevalence ($\Delta\rho = 0.19$, $\tilde{p} = 0.011$) related more positively to dominance-based hierarchy than to prestige-based hierarchy. Admiration expression prevalence ($\Delta\rho = -0.14$, $\tilde{p} = 0.029$) related more to ratings of prestige-based hierarchy than to ratings of dominance-based hierarchy, and we obtained marginal evidence for the same pattern with happy expression ($\Delta\rho = -0.13$, $\tilde{p} = 0.068$). The prevalence of pride expressions did not relate differently to ratings of the two types of hierarchy ($\Delta\rho = -0.002$, $\tilde{p} = 0.968$). Thus, the prevalence of four of the six emotion expressions associated more strongly with ratings of one type of hierarchy than ratings of the other type of hierarchy, and the difference in association strength was marginally significant for a fifth expression.

To gauge relative support for our three theoretical accounts, we then conducted targeted pairwise comparisons between different emotional expressions. First, comparing anger and admiration (which differ in both engagement orientation and valence), we found that admiration was more strongly related to prestige-based hierarchy than anger ($\Delta\rho = -0.19$, $\tilde{p} = 0.033$) but the difference in correlations with dominance-based hierarchy did not reach significance ($\Delta\rho = -0.11$, $\tilde{p} = 0.179$). Second, comparing anger and sadness (which differ in engagement orientation but not valence), we found no differences in their relations with ratings of either dominance-based hierarchy ($\Delta\rho = -0.04$, $\tilde{p} = 0.897$) or prestige-based hierarchy ($\Delta\rho = -0.01$, $\tilde{p} = 0.905$). Third, comparing happiness and admiration (which differ in relevance according to the discrete emotions approach but not in valence or engagement orientation), we again found no differences in relations with ratings of either dominance-based hierarchy ($\Delta\rho = -0.01$, $\tilde{p} = 0.825$) or prestige-based hierarchy ($\Delta\rho = 0.001$, $\tilde{p} = 0.980$). Fourth, comparing happiness and pride (which are similar in valence but differ

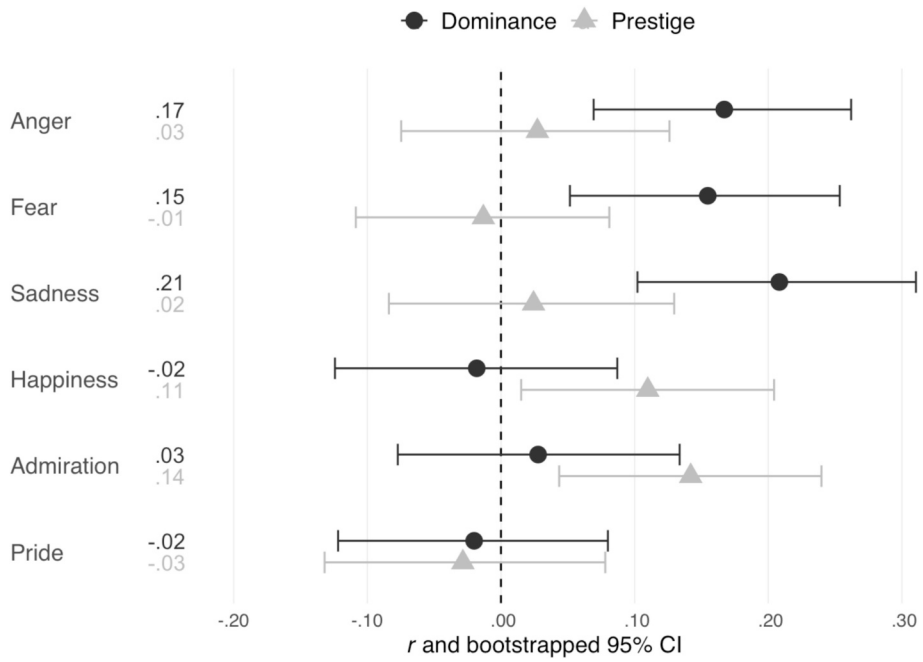

Fig. 1. Zero-order correlations and bootstrapped 95% confidence intervals (10,000 resamples) between perceived reported group hierarchy type and prevalence of emotional expressions in the group (Study 1).

in engagement orientation and relevance according to the discrete emotions approach), correlations with ratings of dominance-based hierarchy did not differ ($\Delta\rho = 0.04$, $\tilde{p} = 0.504$), but happiness correlated more with ratings of prestige-based hierarchy than pride ($\Delta\rho = 0.17$, $\tilde{p} = 0.023$). A complete overview of all other possible pairwise comparisons between expressions can be found in the online supplement.

4.2.2. Rank-specificity of emotional expressions

As can be seen in Table 1, exploratory analyses yielded evidence of limited associations between rank and the likelihood of expressing the six focal emotions. Rank-specificity means ranged from 3.54 to 4.54, and where therefore all close to the mid-point of the scale (i.e., 4); and only two of the 12 correlations with hierarchy types reached significance. Two of the three positive emotional expressions (happiness and pride; but not admiration) were reported significantly more for higher-ranking members than lower-ranking members. Conversely, two of the three negative expressions (fear and sadness; but not anger) were reported significantly more for lower-ranking members than higher-ranking members. Furthermore, the greater prevalence of happiness and pride among higher-ranking members was more likely in more dominance-based hierarchies, but we found no relations between rank-specificity and prestige-based hierarchy. Thus, to the extent we observed rank-specificity, it was valence-based, and relatively weak.

Table 1
Rank-specificity of Expressions and Correlations with Hierarchy Type in Study 1.

Expression	Rank-Specificity	t (382)[a]	$\tilde{p}$	$r_{dominance}$(382)	$r_{prestige}$(382)
Anger	3.97 (1.34)	−0.42	0.674	0.05	0.06
Fear	3.54 (1.27)	−7.18	< 0.001***	−0.08	−0.08
Sadness	3.68 (1.12)	−5.53	< 0.001***	−0.09	−0.03
Happiness	4.27 (1.02)	5.15	< 0.001***	0.16**	0.06
Admiration	4.09 (1.28)	1.36	0.174	0.06	0.05
Pride	4.54 (1.27)	8.36	< 0.001***	0.16**	0.09

Note. [a] Rank-specificity is reported as M (SD) and was tested against the mid-point of the scale ($\mu = 4.00$). Significant values greater (smaller) than 4 mean the emotion is more likely to be expressed by higher-ranking (lower-ranking) members compared to lower-ranking (higher-ranking) members. $\tilde{p}$ values are Holm-Bonferroni adjusted.
* $\tilde{p} < 0.050$; ** $\tilde{p} < 0.001$; *** $\tilde{p} < 0.001$.

4.3. Discussion

At the most general level, our findings confirm that the prevalence of different emotion expressions covaries systematically with the way a hierarchy is constituted in groups. The prevalence of four of the six studied emotional expressions (anger, fear, sadness, admiration) related differentially to the two hierarchy types, and the difference was marginally significant for a fifth expression (happiness). The pattern of correlations did not unequivocally support one theoretical perspective over another, however. Supporting the valence-based account, dominance-based hierarchies were generally associated with more frequent expressions of negative emotions (anger, sadness, fear), and prestige-based hierarchies with more frequent expression of positive emotions (admiration, happiness). Counter to the valence-based account, however, pride expressions, although of pleasant valence, were not more prevalent in prestige-based hierarchies. The social engagement-based account also received some support as (disengaging) pride expressions correlated less with prestige-based hierarchy than (engaging) happy expressions. Yet, counter to this account's predictions, (engaging) sad expressions did not relate less to dominance than (disengaging) angry expressions. The discrete emotions account, finally, received least support. In line with this perspective, the prevalence of pride did not differ between types of hierarchy whereas the prevalence of anger, fear, and admiration did. Yet, counter to this perspective, which postulates them as irrelevant, the prevalence of happy and especially sad expressions also clearly linked to hierarchy type. Finally, we found that positive emotions are somewhat more frequently expressed by higher-ranking members than lower-ranking members; and vice-versa for negative emotions; and that this rank-specificity was largely independent of the type of hierarchy. These findings echo the idea that higher rank in general is associated with experiencing and

expressing more positive emotions than lower rank (Keltner et al., 2003; Van Kleef & Lange, 2020). Interestingly, we did not observe this rank-specificity for anger and admiration, which are two of the three expressions that best differentiate between hierarchy types according to the discrete emotions account. Moreover, the rank-specificity of other expressions was limited in magnitude, suggesting that none of the studied expressions is exclusive to either higher-ranking or lower-ranking members.

In addition to the obvious limitation that causality cannot be inferred from these correlations, it is important to note that these findings are based on subjective impressions of groups that spontaneously come to mind. Clearly, participants were biased toward choosing favourable groups, and their answers may have been distorted by inaccurate memory as well as self-presentational motives. For instance, participants may have been biased toward over-reporting of rare but salient expressions, or may have generalized from one or two individuals with salient expressions toward the team as a whole (Goldenberg et al., 2021; Goldenberg et al., 2022). Moreover, despite the use of pre-existing measures (de Waal-Andrews et al., 2015), the reliability of our hierarchy type measures, and particularly the one for dominance-based hierarchy, was suboptimal. To resolve these limitations, Studies 2 to 5 experimentally tested the effects of emotional expressions on hierarchy type inferences with improved hierarchy type measures.

5. Study 2

To provide initial causal evidence for the links between emotional expressions and hierarchy type inferences, in Study 2, we used the emotion aperture paradigm (Sanchez-Burks et al., 2016) to manipulate a group's facial expressions and measured observers' inferences about the hierarchy in the group. We started with a limited design including just three emotional expressions: angry, neutral, and happy. In selecting expressions from the six that were tested in Study 1 for our experimental studies, we prioritized emotions (a) that could be linked to all three theoretical accounts and (b) with well-established facial expressions available in validated stimulus sets, to be able to conceptually replicate our findings using both facial expressions (Studies 2 and 4) and verbal manipulations (Studies 3 and 5) as stimuli. Although admiration fits the first criterion better than happiness, a reliable and unambiguous expression for admiration has not (yet) been identified (Sauter, 2017). Because happiness and admiration were indistinguishable in their links to hierarchy types in Study 1, we therefore opted for happiness instead. We introduced the neutral condition to isolate the effects of angry and happy expressions, which are obscured if they are only compared to each other. All three theoretical perspectives predict that angry expressions convey a more dominance- and less prestige-based hierarchy than neutral expressions (H1). Although the discrete emotions account does not link happiness to a specific hierarchy type, our data and the valence- and engagement-based accounts, which received most support in Study 1, do suggest that happy expressions convey a more prestige- and less dominance-based hierarchy than neutral expressions (H2).

5.1. Method

5.1.1. Design and participants

We recruited 264 English-speaking adults via the CrowdFlower platform, and randomly assigned them to an angry, neutral, or happy group expression condition. Three participants (1.1%) were excluded because they had failed an instructional attention check (Oppenheimer et al., 2009), leaving a sample of 140 men and 121 women (age $M = 36.56$, $SD = 10.87$, range = 21–68). Sample size was determined a-priori using a power analysis as 252 participants, and we oversampled by 5% to account for exclusions. According to a sensitivity analysis in *G*Power* (Faul et al., 2009), our resulting sample size provided 80% power for a small omnibus effect of f = 0.193/f2 = 3.7% using a one-way ANOVA, and $d = 0.38$ pairwise differences between conditions (one-tailed *t*-test, 261/3 = 87 participants per group).

5.1.2. Materials and procedure

5.1.2.1. Manipulating emotion expression. We first selected two base photos from the *Emotional Aperture Measure* (Sanchez-Burks et al., 2016; Sanchez-Burks & Huy, 2009) depicting a group of four people (two men, two women) wearing business attire in an office environment. We replaced the faces in the original stimuli with emotion expression stimuli from the *Radboud Faces Database* (*RaFD*, Langner et al., 2010) using a photo-editing program. We selected eight individuals from the *RaFD* with the highest overall genuineness ratings (validation data can be obtained from www.rafd.nl), and used their expressions to create angry, neutral, and happy versions of each group photo (see Fig. 2). This procedure resulted in two unique stimuli for each expression (i.e., one of the two base photos, with four of the eight expression stimuli), which helped ensure the generality of any effects obtained. Note that we did not anticipate or expect any differences between the two stimuli for each expression. Participants saw a randomly selected photo from the resulting set of six photos. We instructed participants that the photo depicted a group within a company, who formed a work team, and occupied different ranks, and who just came out of a meeting. Preliminary analyses indeed revealed no significant differences between the two photos for each expression on the manipulation checks and outcome variables (for details, see OSF), and hence we collapse across them for parsimony of reporting.

5.1.2.2. Measuring hierarchy type. The same measures of dominance and prestige hierarchy as in Study 1 were answered immediately after the manipulation (dominance-based hierarchy: $r(259) = 0.29$, $p < .001$; prestige-based hierarchy: $r(259) = 0.58$, $p < .001$). In addition to these relatively indirect measures of hierarchy type, participants completed two new more direct measures at the end of the study. For dominance-based hierarchy, we asked "To what extent does this group have a dominance-based hierarchy (i.e., higher positions are taken by those who display aggressive and dominant behaviour)?" and for prestige-based hierarchy "To what extent does this group have a prestige-based hierarchy (i.e., higher positions are freely granted to those who possess and share valuable expertise or skills)?". The two measures of dominance correlated $r(259) = 0.38$, $p < .001$, as did the two measures of prestige $r(259) = 0.49$, $p < .001$, demonstrating some (but limited) convergent validity.

5.1.2.3. Manipulation checks. Following several exploratory questions, we asked "To what extent do the group members in the picture express [emotion]?", with separate items for anger, happiness, sadness, and

Fig. 2. Example stimulus for the angry group expressions condition, used in Study 2.

pride (1 = *strongly disagree*, 7 = *strongly agree*). Sadness and pride served to disguise the target emotions and were not analysed. We measured neutrality using two items: "To what extent do the group members in the picture express any emotion?" and "To what extent do the group members in the picture look emotionally neutral?", $r(259) = -0.70$, $p < .001$.

5.2. Results

For descriptives and omnibus *F*-tests, see Table 2. The online supplement contains a complete overview of the relevant contrast tests and zero-order correlations for all studies.

5.2.1. Manipulation checks

Ratings on the anger, neutrality, and happiness manipulation checks were in line with the manipulation. Follow-up pairwise comparisons indicated that each manipulation check was rated higher in the respective condition than in the other two conditions: anger $\tilde{p}$s < 0.001, $ds \geq 2.07$; neutral $\tilde{p}$s < 0.001, $ds \geq 1.70$; happiness $\tilde{p}$s < 0.001, $ds \geq 2.66$. Thus, the manipulation of group emotional expressions was successful.

5.2.2. Perceived hierarchy type

A series of ANOVAs revealed significant effects of the manipulation on three of the four measures of hierarchy type, and a marginally significant effect on the fourth (i.e., the indirect measure of dominance-based hierarchy, $p = .078$; see Table 2), confirming that emotional expressions drive inferences about the predominant type of hierarchy in groups. Follow-up planned contrast tests compared angry versus neutral expressions (H1) and happy versus neutral expressions (H2) using the *emmeans* package for R (Lenth, 2020). We used Holm-Bonferroni adjusted one-tailed tests ($\tilde{p}$) to correct for testing each contrast four times (i.e., four DVs). Although angry group expressions did not impact perceptions of a dominance-based hierarchy (both measures $\tilde{p}$s $= 0.197$, $ds \leq 0.20$), they did decrease perceptions of a prestige-based hierarchy (both measures $\tilde{p} < 0.001$, $ds \leq -0.58$). Conversely, happy group expressions decreased perceptions of a dominance-based hierarchy (direct measure $\tilde{p} < 0.001$, $d = -0.58$; indirect measure $\tilde{p} = 0.117$, $d = -0.18$) and increased perceptions of a prestige-based hierarchy (both measures $\tilde{p}$s ≤ 0.001, $ds \geq 0.52$). Hence, H1 was partially supported and H2 was fully supported.

5.3. Discussion

Our findings converge with those from Study 1 and provide first causal evidence that people indeed use a group's emotional expressions to infer its hierarchy type: Compared to neutral expressions, expressions of anger resulted in hierarchy perceptions that were less prestige-based, whereas expressions of happiness resulted in hierarchy perceptions there were less dominance-based and more prestige-based. In terms of the theoretical accounts, these findings are again in line with the valence and social engagement accounts, and contrast with the discrete emotions account, which does not link happiness to a specific hierarchy type. The remaining studies therefore focus primarily on disentangling the valence and social engagement accounts.

Table 2
Means (SD) and Omnibus F-tests for Study 2 (Photographs).

Measure	Angry	Neutral	Happy	$F(2, 258)$	η_p^2
Dominance (indirect)	4.89 (1.42)	4.68 (1.16)	4.44 (1.35)	2.57	0.02
Dominance (direct)	5.03 (1.65)	4.71 (1.65)	3.74 (1.71)	14.26 ***	0.10
Prestige (indirect)	3.30 (1.46)	4.19 (1.21)	5.19 (1.12)	48.80 ***	0.27
Prestige (direct)	3.26 (1.68)	4.16 (1.51)	4.97 (1.44)	26.74 ***	0.17
MC: Anger	6.37 (1.04)	3.54 (1.62)	1.70 (1.39)	260.86 ***	0.67
MC: Neutral	1.78 (1.10)	5.08 (1.42)	2.48 (1.44)	147.96 ***	0.53
MC: Happiness	1.44 (0.92)	2.00 (1.24)	5.90 (1.54)	325.37 ***	0.72

Note. MC = Manipulation Check.
*** $p < .001$.

6. Study 3

In Study 3, we tested the generalizability of the findings from Study 2 using a different type of manipulation (i.e., vignettes) and extended our design by including expressions of sadness. We chose sadness because of the availability of validated facial expression stimuli (as in Study 2), as well as its potential to help disentangle the valence and social engagement accounts. The valence account predicts that all negative emotion expressions have a similar impact on hierarchy perceptions; hence sad and angry expressions, which are similar in valence (Barrett & Russell, 1998; Russell, 1980), should both convey that a hierarchy is more dominance-based (and less prestige-based) than neutral expressions (as found in Study 1). The social engagement account, however, predicts that expressions of sadness, as a socially engaging emotion, should convey that the hierarchy is less dominance-based (and more prestige-based) than expressions of anger (a socially disengaging emotion). The discrete-emotions account, finally, predicts that sad expressions will not convey a different hierarchy type than neutral expressions because sadness is not among the handful of emotions that are specific to one hierarchy type (i.e., anger, fear, and admiration). Given these different predictions, we did not specify a hypothesis about the effects of sad expressions. However, we did expect to replicate the support for hypotheses H1, that angry expressions convey a more dominance- and less prestige-based hierarchy than neutral expressions; and H2, that happy expressions convey a more prestige- and less dominance-based hierarchy than neutral expressions. Furthermore, because of the suboptimal internal consistency and convergent validity of the two-item indirect measures of hierarchy type used in Studies 1 and 2, we replaced them with a longer one.

6.1. Method

6.1.1. Design and participants

We randomly assigned participants to an angry, sad, neutral, or happy group expression condition. We recruited 580 English-speaking adults from the Amazon MTurk participant pool and excluded 18 participants (3.1%) for failing the attention check (same as in Study 2). The final sample consisted of 316 women, 245 men, and one individual who self-identified as "other", $M_{age} = 38.07$, $SD = 12.16$, range 18–63 (after discarding two impossible values). Sample size was determined a-priori using power analysis as 560 participants, and we oversampled slightly to account for exclusions. According to a sensitivity analysis in *G*Power* (Faul et al., 2009), our final sample provided 80% power for a small omnibus effect of $f = 0.14/f^2 = 2.0\%$ using a one-way ANOVA, and $d = 0.34$ pairwise differences between conditions (two-tailed *t*-test, $562/4 \approx 140$ participants per condition).

6.1.2. Materials and procedure

6.1.2.1. Manipulating emotion expression. In the anger condition, participants read the following vignette: "Imagine a group of four people who work in the same company and who form a work team that meets on a regular basis. The members of the team occupy different ranks, with some being placed higher than others. Imagine the members are just coming out of a team meeting among the four of them. As the team members leave the meeting room, they all have an angry look on their face. It is clear from their expressions that the team members feel angry."

The word *angry* was replaced with *sad*, *neutral*, or *happy* in the respective conditions.

6.1.2.2. Measuring hierarchy type. We replaced the two-item (indirect) measures used in Studies 1 and 2 with newly developed eight-item scales based on theoretical work on these constructs (Cheng et al., 2013). The full scales can be found in the Appendix. The resulting scales were internally consistent: dominance-based hierarchy (8 items), $\alpha = 0.89$ and prestige-based hierarchy (8 items), $\alpha = 0.95$. For comparison purposes, we also included the single-item (direct) measures of hierarchy type used in Study 2 later in the survey. The two measures of dominance-based hierarchy were substantially positively correlated, $r(560) = 0.78$, $p < .001$, as were the two measures of prestige-based hierarchy, $r(560) = 0.61$, $p < .001$, indicating that we measured largely the same variable across both approaches.

6.1.2.3. Manipulation checks. Following several exploratory measures, participants completed the same manipulation checks as in Study 2, which included an item checking perceived sadness. The items checking neutral expressions correlated $r(560) = -0.63$, $p < .001$.

6.2. Results

6.2.1. Manipulation checks

Effects on the anger, sadness, neutrality, and happiness manipulation checks were in line with the manipulation (for descriptive statistics and omnibus *F*-tests, see Table 3). Follow-up pairwise comparisons indicated that each manipulation check was rated higher in the respective condition than in the remaining three conditions: anger $\tilde{p}s < 0.001$, $ds \geq 1.96$; sadness $\tilde{p}s < 0.001$, $ds \geq 1.61$; neutral $\tilde{p}s < 0.001$, $ds \geq 2.19$; happiness $\tilde{p}s < 0.001$, $ds \geq 1.77$. Hence, the manipulation of group emotional expression was successful.

6.2.2. Perceived hierarchy type

We again used omnibus ANOVAs followed by tests of specific contrasts. The ANOVAs revealed significant effects of the manipulation on all four measures of hierarchy type (see Table 3). We first tested the same contrasts as in Study 2. Angry (versus neutral) expressions increased perceptions of the hierarchy as dominance-based according to both dominance-based hierarchy measures (one-tailed $\tilde{p}s < 0.001$, $ds \geq 0.57$) and decreased perceptions of the hierarchy as prestige-based according to both prestige-based hierarchy measures (one-tailed $\tilde{p}s < 0.001$, $ds \leq -0.63$), supporting H1. Conversely, happy (versus neutral) expressions caused perceptions of the hierarchy to be less dominance-based (one-tailed $\tilde{p}s < 0.001$, $ds \leq -0.43$) and more prestige-based (one-tailed $\tilde{p}s < 0.001$, $ds \geq 0.47$), supporting H2. Moreover, comparing sad to neutral expressions, we found that sad expressions caused perceptions of the hierarchy to be more dominance-based on the direct measure (two-tailed $\tilde{p} = 0.041$, $d = 0.31$), but not the scale measure (two-tailed $\tilde{p} = 0.103$, $d = 0.26$), and there were no differences on the prestige measures ($\tilde{p}s \geq 0.756$, $ds \geq -0.11$). Proceeding to the crucial contrast test between sad and angry expressions, we found that sad expressions caused the hierarchy to be perceived as less dominance-based according to both dominance-based hierarchy measures (two-tailed $\tilde{p}s < 0.009$, $ds \leq -0.31$) and as more prestige-based according to both prestige-based hierarchy measures (two-tailed $\tilde{p}s < 0.001$, $ds \geq 0.56$). Taken together, we replicated support for H1 and H2 (i.e., angry group expressions causing perceptions of a dominance-based hierarchy, happy group expressions causing perceptions of a prestige-based hierarchy). Moreover, we found that sad expressions lead to perceiving a less dominance-based and more prestige-based hierarchy than angry expressions, but the difference between sad and neutral expressions was inconclusive.

Table 3
Means (SD) and Omnibus F-tests for Study 3 (Vignettes).

Measure	Angry	Sad	Neutral	Happy	$F(3, 558)$	η_p^2
Dominance (scale)	4.13 (1.32)	3.70 (1.45)	3.35 (1.24)	2.75 (1.46)	25.77 ***	0.12
Dominance (direct)	4.69 (1.60)	4.00 (1.69)	3.49 (1.51)	2.75 (1.75)	35.78 ***	0.16
Prestige (scale)	4.21 (1.12)	4.73 (0.95)	4.79 (0.78)	5.23 (0.84)	29.12 ***	0.14
Prestige (direct)	3.86 (1.58)	4.67 (1.52)	4.82 (1.33)	5.59 (1.29)	35.21 ***	0.16
MC: Angry	5.78 (1.16)	3.12 (1.55)	2.68 (1.40)	2.22 (1.30)	197.72 ***	0.52
MC: Sad	3.40 (1.66)	5.78 (1.41)	2.65 (1.41)	2.23 (1.43)	160.34 ***	0.46
MC: Neutral	2.34 (1.23)	2.72 (1.25)	5.42 (1.28)	2.51 (1.17)	190.90 ***	0.51
MC: Happy	2.77 (1.68)	3.09 (1.73)	3.45 (1.63)	6.21 (1.15)	146.79 ***	0.44

Note. MC = Manipulation Check.
*** $p < .001$.

6.3. Discussion

This study yielded full support for H1 and H2 with a verbal manipulation rather than photos and with a new measure of hierarchy type, conceptually replicating Study 2. Thus, speaking to our primary research objective, this study further supports that people use the emotional expressions of group members to draw inferences about the group's hierarchy type. Furthermore, the inclusion of a sad expressions condition helped differentiate between the valence account and social engagement accounts. The results showed that valence alone does not fully explain how emotional expressions impact perceptions of the prevalent hierarchy type, with the inferred hierarchy type differing between two emotional expressions of similar valence, namely anger and sadness. Specifically, sad group expressions led to perceiving a less dominance- and more prestige-based hierarchy than angry group expressions. At the same time, sad expressions may have reinforced perceptions of a dominance-based hierarchy compared to neutral expressions, although this evidence was more ambiguous and limited to one of the four measures. This aligns with prior work (Rothman & Magee, 2016), which also suggests that social (dis)engagement may not completely override valence effects; instead it likely drives within-valence rankings of emotions according to their (dis)engaging nature.

Going back to the different predictions derived from the three theoretical perspectives, our accumulated findings suggest a combination of the valence and social engagement accounts, with social engagement distinguishing between emotional expressions of similar valence. In Study 4 we aimed to confirm this finding and extended our design further with a socially disengaging positive emotion: pride.

7. Study 4

In this study, we further tested the generalizability of our findings using the photo paradigm from Study 2. The use of a different facial expression stimulus set enabled us to include sadness and pride conditions as well. Based on the combined valence and social engagement account that received most support in Study 3, we expected sad group expressions to convey a more dominance- and less prestige-based hierarchy than neutral expressions (H3a), while simultaneously conveying a less dominance- and more prestige-based hierarchy than angry expressions (H3b). Given that pride is a positive, disengaging emotion (Kitayama et al., 2006), based on the same theoretical accounts, we expected proud group expressions to signal a less dominance- and more prestige-based hierarchy than neutral expressions (H4a), while simultaneously signalling a more dominance- and less prestige-based hierarchy than happy expressions (H4b). Finally, we introduced measures of affective valence and social engagement orientation to further

distinguish between these perspectives.

7.1. Method

7.1.1. Design and participants

We randomly assigned participants to the angry, sad, neutral, proud, or happy group expression condition. We recruited 470 participants on Amazon MTurk and excluded 26 participants (5.7%) who failed the attention check (same as before). Our final sample contained 241 women and 203 men (M_{age} = 36.12, SD = 10.92, range = 18–71). Sample size was determined a-priori using power analysis as 448; we oversampled by 5% to account for exclusions. According to a sensitivity analysis in *G*Power* (Faul et al., 2009), with our final sample size, we had 80% power to detect a small $f = 0.16/f^2 = 2.7\%$ condition main effect using one-way ANOVAs, and to detect $d = 0.37$ pairwise differences between conditions (one-tailed t-test, 444/5 ≈ 89 participants per cell).

7.1.2. Materials and procedure

7.1.2.1. Manipulating emotional expression. We re-used one of the two photos of a four-member work-group from Study 2, but now replaced members' facial expressions with stimuli from the *Amsterdam Dynamic Facial Expression Set* (van der Schalk et al., 2011) because it also includes sadness and pride expressions.

7.1.2.2. Measuring hierarchy type. Following the manipulations, participants completed the scales we had developed in Study 3 (dominance-based hierarchy, α = 0.96; prestige-based hierarchy, α = 0.95). We again included the direct one-item measures at the end of the survey.

7.1.2.3. Manipulation checks. Participants completed the same manipulation checks as before (neutral items $r[442] = -0.70$, $p < .001$). To explore which facet of pride (i.e., authentic or hubristic) participants perceived in the pride expressions, participants were asked which option best described the feelings of the people in the picture (Tracy & Prehn, 2012): "Accomplished, achieving, confident, fulfilled, productive, has self-worth, successful" to indicate authentic pride, "Arrogant, conceited, egotistical, pompous, smug, snobbish, stuck-up" to indicate hubristic pride, or "Neither of these is correct".

7.1.2.4. Measuring affective valence. To measure emotional valence specifically, we asked "To what extent do the members in the picture…" followed by "express a positive emotion", "feel good", "express a negative emotion", "feel bad" (last two items reversed, α = 0.96), reflecting common terminology to refer to this dimension (Russell & Barrett, 1999).

7.1.2.5. Measuring social engagement orientation. Because we were unable to identify an existing measure of emotions' social engagement properties, we created a new measure, in which we closely followed theoretical work on this construct (Kitayama et al., 2000, 2006; Rothman & Magee, 2016). As described in the introduction, a socially engaging orientation reflects the salience of duties to the group and refers to striving for social interdependence and relational harmony, whereas a socially disengaging orientation affirms the social independence of the self, and reflect concerns for autonomy and personal achievement. We developed 14 items that were intended to tap into these concepts in four ways: (a) verbatim; (b) members' out-going motivations, e.g., being involved; (c) members' in-coming motivation, e.g., being open to other's engagement; (d) group-level manifestations. We created items in pairs, with one item tapping into engagement and the other into disengagement (reverse-scored before analysis) and asked an independent expert on this literature for their evaluation of the construct validity of the scale prior to using it. The items followed the prompt "To what extent are [do] the group members in the picture currently…" and were (a) "engaged with the group", "disengaged with the group", "feel close to each other", "feel distant from each other"; (b) "focus on their group's goals", "focus on their own goals", "involved in the group", "uninvolved in the group"; (c) "strive for connections", "strive for autonomy", "oriented towards the group", "focused on themselves"; (d) "form a tight-knit group", "form a loose-knit group". The resulting scale had high internal consistency (α = 0.95). Using Confirmatory Factor Analysis (available on OSF), we confirmed the divergent validity of the affective valence and social engagement orientation scales.

7.2. Results

7.2.1. Manipulation checks

For descriptive statistics and omnibus F-tests, see Table 4. Follow-up pairwise comparisons indicated that anger ($\tilde{p}$s < 0.001, $ds \geq 1.90$), sadness ($\tilde{p}$s < 0.001, $ds \geq 1.91$), and neutrality ($\tilde{p}$s < 0.001, $ds \geq 1.77$) were perceived more in the respective condition than in the remaining four conditions. Pride was perceived more in the pride condition than in the angry, sad, and neutral conditions ($\tilde{p}$s < 0.001, $ds \geq 2.10$), but not compared to the happy condition, $t(439) = -0.05$, $\tilde{p} = 0.520$. Similarly, happiness was perceived more in the happy condition than in the angry, sad, and neutral conditions ($\tilde{p}$s < 0.001, $ds \geq 3.56$), but not compared to the pride condition, $t(439) = 0.50$, $\tilde{p} = 0.309$. The great majority of participants in the pride condition perceived the group members to feel authentic pride (75 of 88, 84.1%), which is comparable to how pride expressions were perceived in prior research (Tracy & Prehn, 2012). However, 88.6% of participants in the happy condition (78 of 88) also chose this option. The remaining participants in both conditions were equally divided over hubristic and "neither". Thus, despite using validated pictures of emotional expressions, the proud and happy group expression conditions were indistinguishable according to the manipulation checks; the other conditions worked as intended.

7.2.2. Perceived hierarchy type

ANOVAs revealed significant effects on all four hierarchy type measures. For descriptive statistics and ANOVA statistics, see Table 4; effects are visualized in Fig. 3. We again used contrast tests to test our hypotheses and used Holm-Bonferroni adjusted p-values ($\tilde{p}$) because we tested each hypothesis four times. H1 and H2 were again supported: Angry (versus neutral) expressions caused the group hierarchy to be perceived as more dominance-based ($\tilde{p}$s ≤ 0.001, $ds \geq 0.77$) and less prestige-based ($\tilde{p}$s ≤ 0.001, $ds \leq 0.88$). Happy (versus neutral) expressions caused the group hierarchy to be perceived as less dominance-based ($\tilde{p}$s ≤ 0.001, $ds \leq -0.77$) and more prestige-based ($\tilde{p}$s ≤ 0.001, $ds \geq 0.72$).

Contrasts testing H3a and H3b were each significant on three of the four measures. Specifically, compared to neutral expressions, sad expressions caused the group hierarchy to be perceived as more dominance-based according to the scale measure ($\tilde{p} = 0.002$, $d = 0.47$) but not the direct measure ($\tilde{p} = 0.281$, $d = 0.09$), and less prestige-based according to both measures ($\tilde{p}$s ≤ 0.001, $ds \leq -0.54$), supporting H3a. Compared to angry expressions, sad expressions caused the group hierarchy to be perceived as less dominance-based ($\tilde{p}$s ≤ 0.047, $ds \leq -0.30$) and more prestige-based according to the direct measure ($\tilde{p} = 0.039$, $d = 0.34$), but not the scale measure ($\tilde{p} = 0.106$, $d = 0.19$), supporting H3b.

H4a was supported on all four measures: Proud expressions led to a less dominance-based ($\tilde{p}$s ≤ 0.001, $ds \leq -0.86$) and more-prestige based ($\tilde{p}$s ≤ 0.001, $ds \geq 0.48$) hierarchy type inference than neutral expressions. However, H4b was not supported on any of the four measures: Proud and happy expression did not lead to different inferences about the hierarchy type, $\tilde{p}$s ≥ 0.103, $|d|$s ≤ 0.29. Thus, the results supported Hypotheses 1, 2, 3a, 3b, and 4a, but, like on the manipulation checks, we found no differences between the proud and happy conditions, thereby not supporting Hypothesis 4b.

Table 4
Means (SD) and Omnibus F-tests for Study 4 (Photos).

Measure	Angry	Sad	Neutral	Proud	Happy	Total[a]		Partial[b]	
						$F(4, 439)$	η_p^2	$F(4, 437)$	η_p^2
Dominance (scale)	5.15 (1.37)	4.70 (1.59)	4.00 (1.57)	2.66 (1.46)	2.71 (1.44)	50.37 ***	0.31	4.38 **	0.04
Dominance (direct)	5.67 (1.51)	4.46 (1.86)	4.30 (1.78)	2.77 (1.79)	2.93 (1.90)	39.16 ***	0.26	4.80 ***	0.04
Prestige (scale)	3.31 (1.45)	3.55 (1.53)	4.50 (1.23)	5.19 (1.03)	5.40 (0.96)	48.84 ***	0.31	8.97 ***	0.08
Prestige (direct)	2.79 (1.63)	3.36 (1.92)	4.27 (1.74)	5.09 (1.75)	5.59 (1.39)	41.10 ***	0.27	7.85 ***	0.07
Valence	1.43 (0.93)	1.44 (0.85)	2.77 (1.09)	6.20 (1.10)	6.28 (1.13)	503.43 ***	0.82		
Social Engagement	2.52 (1.20)	3.36 (1.49)	2.97 (1.16)	5.64 (1.03)	5.77 (1.16)	138.85 ***	0.56		
MC: Anger	6.38 (1.23)	2.64 (1.74)	3.66 (1.79)	1.56 (1.13)	1.45 (1.04)	171.35 ***	0.61		
MC: Sadness	2.87 (1.90)	6.62 (0.91)	3.99 (1.68)	1.50 (1.06)	1.44 (1.08)	219.16 ***	0.67		
MC: Neutral	1.67 (1.11)	1.47 (0.93)	4.64 (1.68)	2.34 (1.33)	2.06 (1.30)	87.92 ***	0.44		
MC: Pride	1.88 (1.51)	1.75 (1.46)	2.40 (1.64)	5.57 (1.47)	5.58 (1.44)	150.48 ***	0.58		
MC: Happiness	1.27 (0.87)	1.43 (1.21)	1.83 (1.23)	6.03 (1.27)	6.13 (1.38)	382.05 ***	0.78		

Note. [a] omnibus effects of the manipulation in a one-way ANOVA. [b] omnibus effects of the manipulation in an ANCOVA, including Valence and Social Engagement as covariates.
** $p < .010$. *** $p < .001$.

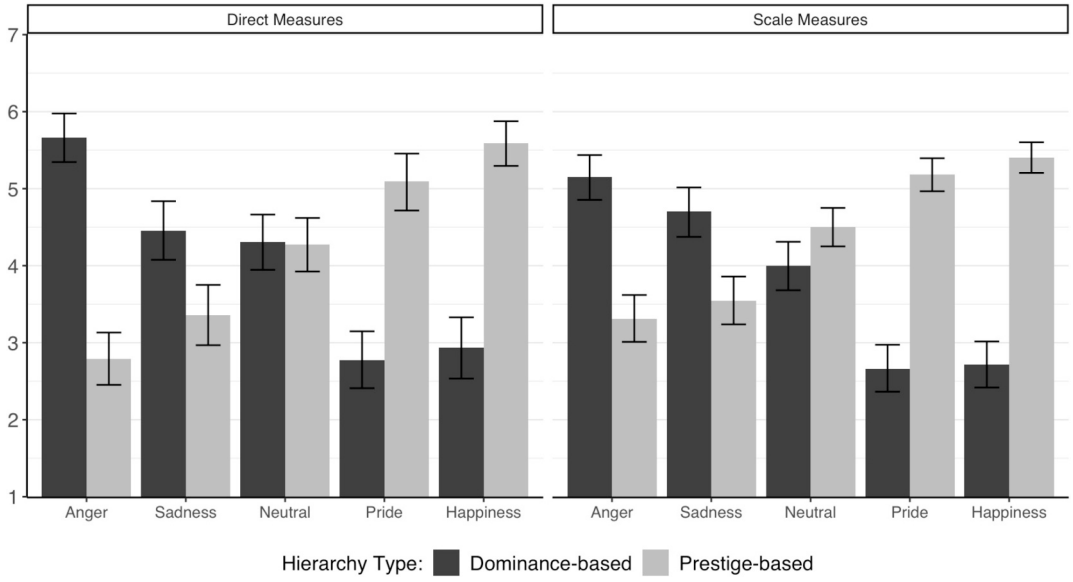

Fig. 3. Effects of emotional expressions on all four measures of hierarchy type inferences (means and bootstrapped 95% confidence intervals; 10,000 resamples) in Study 4.

7.2.3. Affective valence and social engagement orientation

As shown in Table 4, the manipulation also influenced perceptions of affective valence and social engagement orientation. We conducted post-hoc pairwise comparisons between all five conditions (i.e., 10 tests) with Holm-Bonferroni adjusted *p*-values ($\tilde{p}$). Unsurprisingly, we found that positive group expressions (happy, pride) conveyed more positive feelings than neutral expressions, which in turn conveyed more positive (less negative) feelings than the negative expressions (all pairwise comparisons between expressions of different valence $\tilde{p}$s < 0.001, see the online supplement). Moreover, we found no differences in perceived valence between group expressions of similar valence (anger and sad $\tilde{p} > 0.999$; happy and pride $\tilde{p} > 0.999$). On perceived engagement with the group, the happy and pride conditions conveyed more engagement with the group than all other conditions ($\tilde{p}$s < 0.001) but did not differ from each other ($\tilde{p} = 0.375$). Importantly, and in line with the theorized engagement orientation of sadness, the sad condition conveyed more engagement than both the neutral ($\tilde{p} = 0.028$) and angry ($\tilde{p} < 0.001$) conditions. Finally, the angry condition conveyed less engagement than the neutral condition ($\tilde{p} = 0.007$). Taken together, perceived emotional valence and social engagement orientation were influenced in largely similar ways by the manipulations, except for one crucial difference: Angry and sad expressions did not differ in perceived valence, but sad expressions conveyed greater social engagement than angry expressions.

As a final analytic step, we included perceived valence and perceived social engagement orientation along with the manipulation in a series of ANCOVAs on the four hierarchy type measures. This analysis yielded a partial effect of condition, removing the effects of the covariates, which in mediation analysis parlance amounts to the direct effect. In addition, we can assess the relative importance of the covariates (i.e., mediators) by comparing their effect sizes. We found that the omnibus manipulation effect on all outcomes was substantially reduced by including the covariates (see Table 4). We then compared the magnitude of the fully standardized coefficients for valence and engagement orientation in each of the four models using the *multcomp* package for R (Hothorn et al., 2008). On the dominance scale measure, we found no difference between the coefficients for valence ($\beta = -0.27$, $F[1437] = 7.64$, $p = .006$) and engagement orientation ($\beta = -0.51$, $F[1437] = 66.79$, $p < .001$), $t(437) = -1.60$, $p = .109$. Yet, the direct dominance measure was more strongly related to engagement orientation ($\beta = -0.55$, $F[1437] = 72.87$, $p < .001$) than to valence ($\beta = -0.25$, $F[1437] = 5.80$, $p = .016$), $t(437) = -2.01$, $p = .046$. On the prestige scale measure, we again found no difference between the coefficients for valence ($\beta = 0.38$, $F[1437] = 14.16$, $p < .001$) and engagement orientation ($\beta = 0.42$, $F[1437] = 42.94$, $p < .001$), $t(437) = 0.22$, $p = .824$. Neither did we find any

difference between the coefficients for valence (β = 0.45, F[1437] = 19.01, $p < .001$) and engagement orientation (β = 0.39, F[1437] = 36.74, $p < .001$), t(437) = −0.40, $p = .690$ on the direct prestige measure. Taken together, our findings are consistent with a model in which perceived valence and perceived social engagement orientation explain how emotional group expressions impact hierarchy inferences. However, this is only correlational evidence, and alternative models cannot be ruled out, including a reversed causal order (Fiedler et al., 2018). But these analyses do show that of the two candidate mediators, for dominance inferences in particular, perceived social engagement orientation may be most important.

7.3. Discussion

In this study, we replicated the support for H1 and H2 found in previous studies and replicated the difference between angry and sad expressions that we found in Study 3, with sad expressions conveying a more prestige-based and less dominance-based hierarchy than angry expressions. Moreover, we now also found consistent differences between sad and neutral expressions, with sad expressions conveying a less prestige-based and more dominance-based hierarchy than neutral expressions. We extended this evidence by including measures of perceived emotional valence and perceived social engagement orientation. The pattern of findings on these measures was informative, because only the social engagement orientation measure showed a difference between sad and angry expressions, thereby more closely resembling the pattern of findings on the hierarchy type measures. However, a direct comparison in the predictive strength of valence and social engagement orientation for the hierarchy measures was somewhat inconclusive, with social engagement orientation correlating more strongly than valence with only one of the two measures of dominance-based hierarchy.

Although we found clear support for our hypotheses for negative emotions, this was not the case for positive emotions. Specifically, we did not find any differences between the happy and pride condition on any of the measures, including the manipulation checks. Indeed, participants perceived a great amount of happiness in the pride condition. Although this pattern may be explained in several theoretical ways (further detailed in the General Discussion), we decided to exclude the most obvious one: that this is due to a failed manipulation. One reason why the manipulation may have failed, is that the groups' body postures did not covary with the facial expression, which may be particularly important for pride expressions (Sauter, 2017). We therefore returned to the vignette paradigm from Study 3, enabling us to manipulate pride in a more unambiguous way.

8. Study 5

To provide another look at the consequences of different positive emotional expressions for hierarchy type inferences, our final study reused the vignette paradigm from Study 3, comparing only neutral, proud, and happy expressions. Based on our reasoning in Study 4, we again expected pride expressions to signal a more dominance-based and less prestige-based hierarchy than happy expressions (H4b), while simultaneously signalling a less dominance-based and more prestige-based hierarchy than neutral expressions (H4a).

8.1. Method

This study was pre-registered at https://osf.io/ey4qz/.

8.1.1. Design and participants

We randomly assigned participants to neutral, pride, and happy group expression conditions. We conducted a-priori simulations (available on OSF) to determine statistical power to test two contrasts (neutral vs. pride, pride vs. happy), assumed to be $d = 0.30$ each, on all four DVs, using Holm-Bonferroni corrections (eight tests). We found that 800 participants would result in 96.4% power to confirm both contrasts on at least one DV and ~ 80% power to confirm both contrasts on at least one dominance DV and one prestige DV. We had 59.0% power to confirm all eight tests, but achieving nominal power for all tests would require disproportionally more resources and was therefore unfeasible. We recruited 852 USA-based Prolific Academic users, oversampling to account for exclusions based on the attention check (same as before). After excluding 33 participants who failed the attention check, our final sample included 457 women, 350 men, and 12 individuals choosing "other" (age $M = 40.26$, $SD = 12.14$, range = 19–80).

8.1.2. Materials and procedure

Materials and procedure were the same as in Study 4, except that we replaced the manipulation with the neutral and happy vignettes from Study 3 and added a pride condition, in which group expressions and emotions were described as *proud*. The neutral manipulation check (two items, r[817] = −0.71, $p < .001$), dominance-based hierarchy (eight items, α = 0.94), prestige-based hierarchy (eight items, α = 0.90), perceived affective valence (four items, α = 0.82) and perceived social engagement orientation (14 items, α = 0.91) were again internally consistent.

8.2. Results

8.2.1. Manipulation checks

Perceived happiness, pride, and neutrality in each condition and omnibus F-tests are presented in Table 5. Follow-up pairwise comparisons indicated that neutral ($\tilde{p}$s ≤ 0.001, ds ≥ 2.29) and pride ($\tilde{p}$s ≤ 0.001, ds ≥ 2.70) were perceived more in the respective condition than in the other two conditions. Happiness was perceived more in the happy condition than in the neutral condition ($\tilde{p} < 0.001$, $d = 2.05$), but the difference with the pride condition was only marginally significant ($\tilde{p} = 0.085$, $d = 0.12$). Although the pride and happy conditions did not differ in perceived happiness, they did differ in perceived pride, and we deemed the expression manipulation successful.

8.2.2. Perceived hierarchy type

ANOVAs revealed significant effects on all four hierarchy type measures (see Table 5). We again tested our hypotheses using contrast tests and applied Holm-Bonferroni adjustment because we tested each hypothesis four times ($\tilde{p}$). In line with H2, happy (versus neutral) expressions caused the group hierarchy to be perceived as less dominance-based ($\tilde{p}$s ≤ 0.001, ds ≤ −0.46) and more prestige-based ($\tilde{p}$s ≤ 0.001, ds ≥ 0.31). H4a was also fully supported, with proud expressions leading to a less dominance-based ($\tilde{p}$s < 0.001, ds ≤ −0.46) and more prestige-based ($\tilde{p}$s < 0.001, ds ≥ 0.38) hierarchy type inference than neutral expressions. We found no support for H4b, however: Proud expressions did not cause the hierarchy to be perceived as more dominance-based and less prestige-based than happy expressions (one-tailed $\tilde{p}$s > 0.999). In fact, we even found marginally significant evidence in the opposite direction on the prestige direct measure when using a two-tailed test, suggesting that pride expressions may convey a *more* prestige-based hierarchy than happy expressions, t(815) = 1.79, $p = .074$, $d = 0.15$.

8.2.3. Affective valence and social engagement orientation

As shown in Table 5, the manipulation influenced both perceived affective valence and perceived social engagement orientation. Post-hoc pairwise comparisons with Holm-Bonferroni adjustment indicated that both positive emotional expressions were perceived as more positive than neutral expressions ($\tilde{p}$s < 0.001) and as more engaged than neutral expressions ($\tilde{p}$s < 0.001). Interestingly, and counter to theoretical expectations, we found marginally significant evidence that pride expressions were more perceived as more positive ($\tilde{p} = 0.054$) and more engaged ($\tilde{p} = 0.080$) than happy expressions.

As a final analytic step, we again included perceived valence and

Table 5
Means (SD) and Omnibus F-tests for Study 5 (Vignettes).

Measure	Neutral	Proud	Happy	Total[a]		Partial[b]	
				$F(2, 816)$	η_p^2	$F(2, 814)$	η_p^2
Dominance (scale)	3.52 (1.24)	2.91 (1.27)	2.89 (1.27)	22.04 ***	0.05	3.27 *	0.01
Dominance (direct)	3.80 (1.77)	3.00 (1.75)	2.99 (1.70)	19.44 ***	0.05	5.72 **	0.01
Prestige (scale)	4.95 (0.94)	5.29 (0.90)	5.24 (0.94)	10.83 ***	0.03	5.89 **	0.01
Prestige (direct)	4.76 (1.43)	5.44 (1.41)	5.24 (1.46)	16.14 ***	0.04	1.79	0.00
Valence	4.37 (0.98)	6.09 (0.99)	5.92 (1.12)	231.08 ***	0.36		
Social Engagement	4.26 (0.87)	5.28 (0.87)	5.15 (0.88)	111.41 ***	0.21		
MC: Neutral	5.56 (1.34)	2.53 (1.17)	2.70 (1.23)	508.53 ***	0.55		
MC: Pride	3.18 (1.80)	6.20 (1.17)	5.17 (1.37)	298.01 ***	0.42		
MC: Happiness	3.22 (1.76)	5.88 (1.06)	6.04 (1.20)	362.49 ***	0.47		

Note. [a] omnibus effects of the manipulation in a one-way ANOVA. [b] omnibus effects of the manipulation in an ANCOVA, including Valence and Social Engagement as covariates.
* $p < .050$; ** $p < .010$; *** $p < .001$.

perceived social engagement orientation along with the manipulation in a series of ANCOVAs on the four hierarchy type measures. Like in Study 4, we found that the omnibus main effect (i.e., direct effect) of the manipulation was substantially reduced after including the covariates. Furthermore, comparison of the (standardized) coefficients indicated that, on three of the four measures, engagement orientation better predicted the hierarchy type inference than perceived valence: Engagement orientation (vs. valence) related more strongly to the dominance scale ($\beta = -0.51$, $F[1814] = 134.58$, $p < .001$ vs. $\beta = -0.12$, $F[1814] = 6.38$, $p = .012$; $t(814) = -4.58$, $p < .001$), the direct dominance measure ($\beta = -0.43$, $F[1814] = 98.65$, $p < .001$ vs. $\beta = -0.22$, $F[1814] = 19.87$, $p < .001$; $t(814) = -2.59$, $p = .010$), and the direct prestige measure ($\beta = 0.38$, $F[1814] = 65.27$, $p < .001$ vs. $\beta = 0.13$, $F[1814] = 5.72$, $p = .017$; $t(814) = 2.82$, $p = .005$). Only on the prestige scale measure did we not observe a difference between the relations with engagement orientation ($\beta = 0.35$, $F[1814] = 55.15$, $p < .001$) and valence ($\beta = 0.22$, $F[1814] = 18.53$, $p < .001$), $t(814) = 1.38$, $p = .168$. Taken together, these findings are again consistent with a model in which perceived social engagement orientation and perceived affective valence explain how expressions impact hierarchy type inferences, but as noted before, this analysis is based on correlational evidence, and the data may be consistent with alternative causal models too (Fiedler et al., 2018). But most importantly, comparing the amount of variance in hierarchy type explained by the two predictors, we found that engagement orientation generally is the more powerful predictor of the two.

8.3. Discussion

Our aim in this study was to compare the effects of happy and proud group expressions to further decide between the valence account and the social engagement account. Despite not finding clear evidence that these expressions differentially influence hierarchy type inferences, we regard the overall pattern of findings in this study to provide more support for the social engagement account than for the valence account. Specifically, we found no differences in the perceived engaging nature of happy and pride expressions, suggesting that the absence of a significant difference between pride and happiness on hierarchy inferences is due to the absence of differences in the social engagement of these emotion expressions, and not simply an artifact of our stimuli. Furthermore, our measure of social engagement orientation correlated more strongly with three of the four hierarchy type inferences than perceived emotional valence did, suggesting that hierarchy type is more closely related to differences in social engagement orientation, than to differences in valence.

9. General discussion

We conducted five studies to (1) test whether group members' emotional expressions provide observers with cues about the degree to which a group's hierarchy is dominance- or prestige-based, and (2) to determine which of three theoretical accounts best explains the patterns of effects. An initial correlational study (Study 1) indicated that the prevalence of a range of emotional expressions indeed covaries with hierarchy type in real-world groups. A series of experiments (Studies 2–5) provided causal evidence that emotions expressed by group members are used by observers to make inferences about the type of hierarchy in a group. Specifically, compared to neutral expressions, angry and sad expressions led observers to infer that the group hierarchy is more dominance- and less prestige-based, whereas happy and proud expressions convey that the hierarchy is less dominance- and more prestige-based. Thus, the pattern generally indicates that the valence of the emotion that is expressed determines the hierarchy type that is inferred. But importantly, the effects of sad expressions (Studies 3 and 4) fell in-between angry and neutral expressions. We interpret this finding as supporting the social engagement account, because anger and sadness differ in engagement but not affective valence. Moreover, we found that perceptions of group members' social engagement orientation better predicted perceived hierarchy type than perceptions of group members' experienced affective valence (Studies 4 and 5). This also helped explain why pride and happy expressions – despite theoretically differing in social engagement – did not differ in their effects on hierarchy type perceptions: Observers rated them similarly in terms of social engagement. Altogether, our findings confirm that people use group member's emotional expressions to draw inferences about the group's hierarchical structure, thereby fulfilling our first research goal. Furthermore, they suggest that the valence and social engagement orientation associated with an emotion are joint determinants of the inferences about a group's hierarchy type.

Our primary goal was to test whether people draw inferences about a group's hierarchy type based on members' emotional expressions. Having demonstrated such inferences, we contribute to the growing literature documenting the emotional dynamics in groups, and hierarchies in particular (Cheng et al., 2010; Tracy et al., 2020; Van Kleef & Lange, 2020; Witkower et al., 2020). While prior research has focused primarily on the role of emotional expressions in within-group hierarchy dynamics, such as in conveying an individual's rank relative to others within a hierarchy (Tiedens, 2001), we studied hierarchy type as a group-level attribute instead. This approach fits a broader trend in which researchers identify more and more links between emotional expressions and group-level attributes, including norms (Hareli et al., 2013; Heerdink et al., 2018), cohesion (Magee & Tiedens, 2006; Rothman & Magee, 2016), and conflict (Homan et al., 2016), which collectively suggest that emotions have important functions in determining many intragroup dynamics (Keltner & Haidt, 1999). Furthermore, classic work on the dominance-prestige framework of rank provides examples suggesting that dominance and prestige can be differentially viable strategies for attaining rank in different groups (e.g., prestige being more viable than dominance in the Semai society; Henrich & Gil-

White, 2001), but such potential between-group differences have largely gone unstudied. Although the notion of equal viability has been disputed at a general level (e.g., Anderson et al., 2015, 2020), we are aware of only one prior study that empirically demonstrated group-level variation in the predominant hierarchy type (de Waal-Andrews et al., 2015). Our findings thus indicate not only that observers can draw inferences about a group's hierarchy type from emotional expressions, but also highlight that variations in the predominant hierarchy type can be meaningfully studied at the group level.

Our secondary goal was to distinguish between three different theoretical accounts of the links between expressions and hierarchy type: (1) a valence account, which posits that negative emotions convey that hierarchies are more dominance- and less prestige-based than positive emotions; (2) a social engagement account, which holds that socially engaging emotions convey that hierarchies are more prestige- and less dominance-based than socially disengaging emotions; and (3) a discrete-emotions account, which suggests that only a few specific emotions convey information about the type of hierarchy. Taken together, our experimental findings support a combination of the valence account and the social engagement account. Moreover, the ANCOVA results in Studies 4 and 5 point to the potential superiority of the latter, although we should note that these analyses do not provide conclusive evidence that valence and social engagement are the (only) mechanisms linking emotional expressions to hierarchy types (Fiedler et al., 2018). Alternative models – including a model in which hierarchy type inferences come about through some other mechanism, and in turn drive inferences about valence and social engagement – cannot be conclusively ruled out analytically. At the same time, differences in hierarchy type inferences more closely resembled differences in perceived social engagement than in perceived affective valence; and a direct comparison of their predictive power also indicated the former predictor's comparative superiority. This is noteworthy because the social engagement dimension is rarely considered in the literature on interpersonal effects of emotion. Effects of emotional expressions are typically explained using a combination of affective reactions and reverse appraisals (Barsade, 2002; Lange et al., 2022; Van Kleef, 2016). Following the pioneering work by Rothman and Magee (2016), we suggest that the social engagement inherent in an emotion might be particularly relevant for understanding how emotions shape intragroup dynamics, as they provide insight into both cohesion and hierarchy, which are central to groups' existence and functioning (Castano et al., 2003; Lickel et al., 2000).

A challenge in developing the social engagement account further is that, unlike the affective valence dimension, onto which most emotions can be mapped in a relatively intuitive, clear-cut, and consistent way (Russell, 1980), there seems to be some flexibility and context-sensitivity in the mapping of emotions onto the social engagement dimension. Indeed, while we have replicated some mappings from prior work (Kitayama et al., 2000, 2006), such that anger would be disengaging, and sadness relatively more engaging, the same literature considers happiness to be a general positive emotion and pride a disengaging emotion (more on pride below). The measures in Studies 4 and 5, however, clearly indicate that both happiness and pride convey a high degree of social engagement. These differences may be partially due to our different methodology, but given the inter-cultural origins of the concept of social engagement orientation, it may also suggest that contextual differences, such as differences in time, place, and sharedness, may play an important role in the exact mapping of emotions. In this light, it is noteworthy that there is some evidence suggesting that even anger, despite being a socially disengaging emotion, can increase social engagement by drawing a group together, if it is shared within a group and experienced toward an outside target (Knight & Eisenkraft, 2015; Livingstone et al., 2016). Thus, social engagement, unlike valence, may not be an immutable quality of emotions, but rather depend on the way the emotion is understood in that particular context. Exploring the contextual contingencies determining such mappings would be a fruitful avenue for future research.

Such context-sensitivities may also play a role in some of the divergent findings between studies, in particular the strong link between sad expressions and dominance-based hierarchy found in Study 1, which we did not replicate experimentally in Studies 2–4. We offer two explanations for this discrepancy. First, although Study 1 aimed to tap into emotional expressions, it is not unlikely that recollected emotional experiences may have biased participants' responses. Indeed, due to the operation of factors such as impression management (Eldesouky & English, 2019), emotion regulation (Tamir & Gutentag, 2017), and conformity to emotion norms (Wolf et al., 2023), what is introspectively available in terms of affective expressions may differ quite substantially from the affective information that is available to observers. Second, and related, other contextual inferences such as what the sadness is thought to be about (e.g., internal or external factors) may play a role. Consensually expressed sadness (as in Studies 3–4) may suggest an external cause, conveying an unambiguous request for assistance (Lench et al., 2016). The methodology of Study 1 also tapped in situations in which sadness was expressed by one or two members, in which case the cause is more ambiguous, and internal factors (such as the dominance dynamics mentioned above) can also be held responsible. We have left these factors intentionally unspecified but as active perceivers, our participants likely made assumptions about these aspects.

A further puzzle concerns pride's social engagement orientation and downstream consequences on hierarchy type perceptions, which were almost indistinguishable from happiness. Although at first sight this may be taken for a methodological issue, we consider this unlikely given the use of validated pride expression stimuli in Study 4, an explicit and unambiguous verbal manipulation in Study 5, and relatively large samples. We instead consider a more substantive interpretation likely. Specifically, we note that while our findings contrast sharply with treatments of pride as a socially disengaging emotion (Kitayama et al., 2006) as well as prior findings in which observers interpreted pride expressions as self-interest (Horberg et al., 2013), there is also research that has found pride experiences to be associated with relatively prosocial action tendencies (Van Osch et al., 2018). This conceptualization is more in line with the relatively benign inferences from pride expressions in our studies. Such inferences may depend crucially on whether a pride expression is interpreted as authentic versus hubristic pride, with the former conveying greater social engagement than the latter. Indeed, in line with prior findings (Tracy & Prehn, 2012), the great majority of our participants interpreted the ambiguous pride expressions in Study 4 as reflecting authentic pride. Perhaps, if contextual factors point to an interpretation as hubristic pride instead, pride expressions can have drastically different consequences. Alternatively, given the consensual expression of this emotion by all group members, our participants may have interpreted these expressions as reflecting (more socially engaging) group-level pride instead of (more disengaging) individual-level pride (Delvaux et al., 2016; Rothman & Magee, 2016). Finally, pride expressions may require an element of contrast (e.g., between individuals, or between groups) to be linked to disengagement, given its rank-enhancing function. Awaiting further exploration, we conclude that in the current context, pride and happy expressions provide similar information about hierarchy type to observers.

Our findings also suggest a potential new explanation for why crises, and specifically inter-group competition, are conducive to the support of dominant and autocratic leaders (Hogg, 2021; Kakkar & Sivanathan, 2017; Laustsen & Petersen, 2017), or leaders that behave in ways that are associated with dominance (e.g., risk-taking Van Kleef et al., 2021). This leader emergence is typically explained in terms of the instrumentality of dominant leaders, e.g., their greater capacity to fight (Laustsen & Petersen, 2017), or changes in the cognitive representation of the group prototype (Hogg, 2021). However, there may be a concurrent emotional route as well: the anxiety and uncertainty associated with these threats may shift the emotion culture in teams toward more disengaging emotions, in turn causing the hierarchy to become more

dominance-based, and less prestige-based. This change in emotion culture would enhance the viability of dominance as a strategy for pursuing leadership.

One potential limitation stems from the fact that in all our experimental studies, the procedure mentioned that the team members just came out of a meeting. This setting implies that team members have interacted only with each other and that other groups were absent -at least physically. Hierarchy-related processes are sensitive to such differences in group context. For instance, the same behaviour (e.g., costly contribution) has been found to have different consequences for dominance and prestige in the presence of a competing group, than in a pure intragroup context (Halevy et al., 2012). Moreover, whether the emotional expressions were assumed to be due to within-team processes or external events may have shaped inferences, as this factor determines both how team emotions impact team processes (Heerdink & Homan, 2024; Knight & Eisenkraft, 2015), and how diagnostic emotional expressions are considered to be of within-team dynamics (Homan et al., 2016). Although in our studies, the expressed emotions could have been plausibly caused by numerous different sources, e.g., all kinds of within-team processes as well as (external) events team members responded to (e.g., after a video call with some other person or a discussion within the team of a situation outside the team that is relevant for them), participants probably more frequently inferred within-team processes. Thus, we recommend that future research explore whether the (assumed) cause of the emotions, as well as inferences about the group context (including the presence or absence of potentially competing groups) matters.

A related limitation on the external validity of our findings is that our experiments exclusively modelled situations in which all group members consensually express the same emotion, at the same time. This experimental setup was intended to unambiguously convey the expressive norm in the observed group, and prioritized high internal validity, which is important in theory-driven research. However, a situation in which an entire group consistently expresses exactly the same emotion with the same intensity at the same time may be relatively rare in day-to-day reality. People do not always (fully) express the emotions they experience (Durán & Fernández-Dols, 2021), and group members with different roles (e.g., depending on rank, but also depending on specific tasks) may experience and express different emotions in the same situation (e.g., Rafaeli & Sutton, 1987; Tiedens et al., 2000). Furthermore, even though our correlational real-world findings (Study 1) are broadly consistent with the later experimental findings, they should not be taken to reflect that people in, say, a dominance-based hierarchy constantly walk around expressing anger either. Indeed, participants' responses may reflect a variety of real-world group experiences, including the expressions of only a significant subgroup of members, alternating emotions expressions, generalizations from high-ranking members' expressions, or salient emotional episodes. Nevertheless, research suggests that even in groups whose members show different emotions (unlike in our studies), observers quickly generate summary judgements that are biased toward the most salient (e.g., high-intensity, negative) expressions (Goldenberg et al., 2021; Sanchez-Burks & Huy, 2009). Thus, it is plausible that even with greater variability in expressions, observers will be able to derive meaningful inferences about hierarchy. Researchers aiming to apply these findings in real-world context should, however, first study live group interactions and consider multiple expressive modalities to find out how exactly moment-to-moment variations in emotional expressions shape the hierarchy type in real-world groups (Lange et al., 2022). Here, we have laid the theoretical groundwork for such further explorations. Our new, theory-driven measure that reliably assesses hierarchy type at the group level, which complements existing scales that measure these constructs at the individual level (Körner et al., 2025), could support such efforts (see Appendix).

10. Conclusion

Taken together, the current findings provide the first evidence that people use the emotional expressions of group members to gauge the group's predominant type of hierarchy – dominance- or prestige-based. Although positive emotional expressions are generally associated with more prestige-based hierarchies, and negative emotional expressions with dominance-based hierarchies – a pattern that fits an interpretation in terms of emotional valence – emotions' social engagement orientation provides a more nuanced and detailed account, with disengaging emotional expressions cuing inferences of dominance and engaging emotional expressions cuing inferences of prestige. While we have taken care to identify the most plausible theoretical perspectives in the emotions literature before running our studies, it is of course possible that yet other theoretical perspectives may be developed to explain the observed associations between emotional expressions and predominant hierarchy types. Similarly, it would be worth extending our findings to other emotional expressions, as well as to virtue-based hierarchies, as a third type of hierarchy (Bai et al., 2020). By providing a first demonstration of these associations, our findings contribute to the growing understanding of the affective underpinnings of a pervasive and functional aspect of human social relations: hierarchy.

Open practices

All materials, data and analyses can be found at https://osf.io/4qdjm/. Study 1 and Study 5 were pre-registered, see https://osf.io/49xzd/ (Study 1) and https://osf.io/ey4qz/ (Study 5). We report how we determined our sample size, all data exclusions (if any), all manipulations, and all measures in all studies.

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Marc W. Heerdink: Writing – original draft, Visualization, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Svenja A. Wolf:** Writing – review & editing, Visualization, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Jens Lange:** Writing – review & editing, Visualization, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Florian Wanders:** Visualization, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Xia Fang:** Methodology, Conceptualization. **Eftychia Stamkou:** Methodology, Conceptualization. **Gerben A. van Kleef:** Writing – review & editing, Methodology, Conceptualization.

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Declaration of competing interest

The authors declare no conflict of interest.

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Appendix A. Hierarchy Type Measure

Hierarchy type measure used in Studies 3–5, based on definitions in Cheng and Tracy (2013). Items 1–8: prestige-based hierarchy; items 9–16: dominance-based hierarchy.

Instructions: For each question below, please indicate your response in the respective response scale. We realize that you have limited information about the group, but please just try your best to estimate what this group would be.

In this group …

1. … higher positions are willingly given to group members who are valued by the rest of the group.
2. … members with lower rank go along with those with higher rank out of genuine respect.
3. … members move up by contributing their knowledge and skills to the group.
4. … members get ahead by earning the esteem of other group members.
5. … lower ranked members yield to those with higher rank because they respect their superior knowledge and skills.
6. … members freely grant higher positions to those who possess and share valuable expertise or skills.
7. … members who demonstrate skills and expertise take higher positions.
8. … members willingly afford rank to the ones who deserve it.
9. … higher positions are forcefully taken by group members who have the ability or means to do so.
10. … members with lower rank go along with those with higher rank because they want to avoid repercussions.
11. … members move up by coercing others.
12. … members get ahead by intimidating other group members.
13. … lower rank members yield to those with higher rank because they are intimidated by them.
14. … lower rank members are intimidated by members with higher rank.
15. … members who display aggressive behaviour take higher positions.
16. … members gain rank by assertively claiming it.

Response scale: *1 = completely disagree* to *7 = completely agree.*

Appendix B. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jesp.2026.104931.

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