Title

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Running head: LAUGHTER CONVEYS STATUS

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Abstract

We propose that status influences individuals' use of dominant versus submissive laughter, and that individuals are conferred status based on the way they laugh. In Study 1, naturally occurring laughter was observed while low- and high-status individuals teased one another. The use of dominant and submissive laughter corresponded to hierarchical variables: High-status individuals and teasers displayed more dominant, disinhibited laughs, whereas low-status individuals and targets of teases displayed more submissive, inhibited laughs. Further, low-status individuals were more likely to vary the form of their laughter between contexts than high-status individuals. Study 2 demonstrated that laughter influences perceptions of status by naïve observers. Individuals who laughed dominantly were afforded higher status than individuals who laughed submissively, regardless of their actual status. Moreover, low-status laughers were perceived to be significantly higher in status, and to have as much status as high-status laughers, when laughing dominantly versus submissively. Finally, exploratory analyses suggest that the positive emotional reactions of observers of laughter can help explain the link between laugh type and status perceptions.

Keywords: laughter, status, social perception, nonverbal behavior, thin slices

Laughter Conveys Status

Perceptions of status—the prestige, rank, admiration, and respect afforded within one's group—are typically accurate within existing groups, wherein members know each other well and observe multiple interactions between various members (Anderson, Srivastava, Beer, Spataro, & Chatman, 2006). However, much less is known about how individuals make inferences about status in zero-acquaintance situations. In this paper, we investigate how status is communicated in laughter. First, we examine whether social status influences how individuals laugh. Second, we test whether individuals can change how others perceive their status by using different forms of laughter. Third, we examine whether and how both of these relationships are moderated by contextual factors.

Laughter is an important behavior to study because it is a rich and variable form of communication (Bachorowski & Owren, 2001; Bachorowski, Smoski, & Owren, 2001) that is ubiquitous, occurring in over 95% of conversations (Provine & Fischer, 1989). Individuals laugh in many ways, and for many reasons: We laugh when amused, to signal agreement, or simply because others are laughing. Certain types of laughter elicit positive affect in others, whereas other types do not (Bachorowski & Owren, 2001). Variations in the sound of laughter communicate specific emotions and intentions (Gervais & Wilson, 2005). However, despite laughter's ubiquity in social interaction, its social functions are not well understood.

Examining whether individuals communicate status through laughter is promising because of laughter's metacommunicative function as a disarming signal of cooperation, cohesion, safety, and jest (Bachorowski & Owren, 2001; Keltner, 2009). Laughing in the presence of others indicates the interaction is safe (Grammer, 1990). For this reason, laughter is often used before, during, or after an act of verbal aggression to make the intention more

ambiguous or less serious; such laughter signals "this is play" (Brown & Levinson, 1987; Grammer, 1990; Grammer & Eibl-Eibesfeldt, 1990; Van Hooff, 1972). The use of laughter to disarm aggression is often volitional and strategic (Gervais & Wilson, 2005; Owren & Bachorowski, 2003). While the norms of most social groups prevent direct, unambiguous acts of aggression and dominance, the use of laughter may free individuals to display dominance because laughter renders the act less serious.

In this way, laughter may also provide a context for the negotiation of status, giving low-status individuals the opportunity to try on high-status roles. Individuals high in status and/or power tend to display particular patterns of nonverbal behavior, including increased expressivity and decreased interpersonal distance (Hall, Coats, & Smith LeBeau, 2005; Kraus & Keltner, 2009). Whereas overt displays of high-status-like behavior from low-status individuals are often punished (Anderson, Ames, & Gosling, 2008), we propose that the context of laughter may allow low-status individuals to display dominance without facing a potential backlash.

Overview of Studies

We investigated three research questions regarding the relationship between status and laughter. First, in Study 1, we examined whether high- and low-status individuals laugh differently. According to approach-inhibition theory (Keltner, Gruenfeld, & Anderson, 2003), higher status often leads to higher power, a psychological state associated with behavioral disinhibition. Application of this theory to the present research leads to two potential hypotheses. First, high-status individuals may simply laugh more than low-status individuals. A second hypothesis, however, is that status affects not the overall amount of laughter but rather the type of laughter: High-status individuals should be more likely to display expressive, disinhibited laughs, whereas low-status individuals should be more likely to display constrained, inhibited

laughs. Given the great variability in types of laughs and the different messages they convey (e.g., Bachorowski & Owren, 2001; Gervais & Wilson, 2005), and given that a recent meta-analysis found no relationship between overall amount of laughter and hierarchical position or rank (Hall et al., 2005), we considered the second possibility more likely. To test this, coders identified laughs that communicated dominance or submissiveness, and we tested whether status influenced their production. Different coders rated the laughs' characteristics to examine how dominant and submissive laughs differ acoustically.

Second, we examined whether contextual factors influence the way a person laughs, and how these factors interact with a person's status in shaping laughter, using a pre-existing dataset including naturally occurring laughs in an ecologically valid setting—interactions in which high- and low-status members of a hierarchical group (a fraternity) took turns teasing and being teased by each other (Keltner, Young, Heerey, Oemig, & Monarch, 1998). Teasing is an ambiguous context involving both aggression and play (Keltner, Capps, Kring, Young, & Heerey, 2001) so laughter may play an important clarifying role. Multiple theories predict that individuals of lower rank or status should display more behavioral variability between contexts than individuals of higher rank or status (e.g., Keltner et al., 2003; Magee & Smith, 2013; but see Guinote 2007, 2008; Kraus et al., 2014; for important qualifying conditions). Thus, we predicted that low-status individuals would shift the form of their laughter more between the roles of teaser and target than high-status individuals.

Third, in Study 2, we examined whether dominant and submissive laughs influence perceived status. Here, naïve observers rated the fraternity brothers' status after listening to their laughs. If low-status individuals can elevate their status by adopting the laugh styles of high-status individuals, such a finding would be a unique characteristic of laughter given that

perceivers are normally sensitive to status indicators (Anderson, Hildreth, & Howland, 2015; Smith & Magee, 2015) and punish those who behave "beyond their rank" (Anderson et al., 2008).

Study 1

To assess how status and hierarchical context influence laughter, we analyzed spontaneous laughter occurring while low- and high-status fraternity brothers took turns teasing (as "teaser") and being teased by (as "target") each other—a task meant to make status salient. After one team of coders identified all laughs, a second team identified whether each laugh conveyed dominance, submissiveness, or neither, and a third team judged the laughs' acoustic properties. We analyzed whether a laugher's status and his temporary role as teaser or target influenced the amount and type of laughter produced.

Method

Participants and Procedure

Forty-eight male members of a U.S. public university fraternity were randomly assigned to one of 12 groups of four, each consisting of two low-status members ("pledges" who had joined the fraternity one month prior) and two high-status members (active in the fraternity for at least two years). To heighten status distinctions, low-status members were seated next to one high-status member and directly across from the other high-status member.

Each group was videotaped as they engaged in a round-robin teasing task, during which each member teased and was teased by each of the other three members. Teasers generated nicknames for targets based on randomly generated sets of initials (e.g., L.I. became "Loser Idiot") and then told teasing stories about why they chose each nickname. Participants were instructed to speak and act naturally while telling their stories.

Coding of Dominant and Submissive Laughs

Two coders identified each instance of laughter (agreement=94%; disagreements resolved by discussion) from the videos, including laughs occurring through speech. The teasing paradigm elicited numerous spontaneous laughs (see Table 1). A separate team of two coders, blind to study hypotheses and laugher status, independently watched each group's entire interaction and judged how submissive to dominant each laugh was (α=.97) on a scale of -3 (*definitely submissive*) to 3 (*definitely dominant*). These ratings were then transformed into a categorical classification. Laughs receiving average ratings of two or higher were classified as dominant, whereas laughs receiving average ratings of -2 or lower were classified as submissive.

Table 1

Descriptive Statistics for Laughs in Study 1

Overall statistics	Total	Percentage
All laughs	694	100%
Dominant laughs	235	34%
Submissive laughs	167	24%
Neither submissive nor dominant	292	42%
By participant	*M*	*SD*
All laughs	14.48	6.77
Dominant laughs	4.90	3.84
Submissive laughs	3.48	3.63

Coding of Laugh Characteristics

A third team of two coders, blind to hypotheses, laugher status, and laugher role, listened to each laugh without any accompanying video, rating them for the following characteristics on 1 to 7 scales: vocal intensity (i.e., loudness; α=.76), pitch (α=.64), pitch range (α=.72), pitch

modulation (α=.58), airiness (α=.61), and burst speed (α=.75). Coders listened to each laugh as many times as desired. Pitch was rated relative to each participant's voice to account for individual variation. Pitch range was defined as the distance between the highest and lowest pitch occurring during a laugh episode. Pitch modulation assessed how often (but not to what degree) laugh pitch changed during a laugh episode. Burst speed assessed the average speed of each laugh burst (i.e., a single "hah"). Coders also indicated whether or not each laugh co-occurred with another participant's laughter (yes/no; κ=.80).

Most of these characteristics were chosen for their links to behavioral disinhibition. If dominant laughs are more disinhibited than submissive laughs, as we hypothesize, they should exhibit greater vocal intensity, more pitch range and modulation, and greater burst speed. We included airiness and co-occurrence to provide a richer description of the laughs and did not have hypotheses for these, nor did we have a prediction regarding pitch. Some research has found hierarchical variables to be associated with lower-pitched voices (e.g., Mayew, Parsons, & Venkatachalam, 2013; Puts, Gaulin, & Verdolini, 2006; Stel, van Dijk, Smith, van Dijk, & Djalal, 2012), but a meta-analysis found no relationship between hierarchical position and pitch (Hall et al., 2005), and other research suggests feeling more powerful raises one's vocal pitch (Ko, Sadler, & Galinsky, 2015).

Results

To account for the nested, non-independent nature of the data, three-level hierarchical linear models were employed for all analyses within R statistics using the lme4 (Bates & Maechler, 2009), lmerTest (Kuznetsova, Brockhoff, & Christensen, 2015) and language (Baayen, 2009) packages. In all models with dominant and submissive laughs as outcomes, we control for total number of laughs to provide insight into the relative balance of dominant and

submissive laughter, instead of absolute differences. All predictors were kept fixed because of the limited number of observations per higher order unit.[1]

Dominant and Submissive Laughs Sound Different

We predicted that dominant laughs would be more expressive and disinhibited than submissive laughs. To test this, we created a dummy variable that compared dominant to submissive laughs in a three-level HLM model with laughs (level 1) nested within laughers (level 2) nested within groups (level 3). In each model, the acoustic property was the outcome and laugh type (1=dominant, 0=submissive) was a level-1 fixed predictor. Table 2 lists means, standard deviations, and p-values. Compared to submissive laughs, coders perceived dominant laughs as louder, more variable in pitch, and having more pitch modulation. Dominant laughs were perceived as higher in pitch, less airy, and featuring faster bursts than submissive laughs, and were more likely to co-occur with others' laughter.

Table 2

Dominant and Submissive Laugh Characteristics (Study 1)

	Dominant Laughs	Submissive Laughs	P-Value of Difference
Vocal Intensity	2.73 (1.97)	1.96 (1.85)	<.001
Pitch	3.00 (1.97)	2.33 (2.03)	.008
Pitch range	1.26 (1.09)	0.94 (1.06)	.003
Pitch modulation	1.17 (0.98)	0.84 (0.92)	.002
Airiness	4.01 (2.06)	4.70 (2.11)	.001
Burst speed	1.90 (1.48)	1.31 (1.30)	<.001
Co-occurring	84% (37)	74% (44)	.03

Note. Standard deviations are in parentheses.

Status Influences Type, but not Amount, of Laughter

We predicted that high- versus low-status individuals would engage in more dominant laughter and less submissive laughter. Here, we employed a three-level HLM model with conversations (level 1) nested within individuals (level 2) nested within groups (level 3), and included status as a level-2 dummy variable (1=high status, 0=low status). Overall, high- and low-status individuals did not differ in total amount of laughter, b=-.19, CI_{95}(-.74, .37), t=-.67, p=.51, consistent with the Hall et al. (2005) meta-analysis. As predicted, high-status individuals produced significantly more dominant laughs, b=.55, CI_{95}(.24,.86), t=3.52, p<.01, and fewer submissive laughs, b=-.53, CI_{95}(-.82, -.24), t=-3.66, p<.01, than low-status individuals (see Figure 1).

Teasers Produce Relatively More Dominant and Fewer Submissive Laughs than Targets

We predicted that teasers would produce more dominant laughs and fewer submissive laughs than targets, given the power differences inherent in these roles. We once again employed the conversation-focused HLM model and included target versus teaser as a level 1 dummy variable (1=teaser, 0=target). Overall, targets laughed significantly more than teasers, b=-1.40, CI_{95}(-1.79, -1.00), t=-6.97, p<.01, so we included total laughter as a level-1 control predictor in two subsequent models examining the number of dominant and submissive laughs in each role, respectively.[2] As predicted, teasers produced significantly more dominant laughs, b=.44, CI_{95}(.23, .65), t=4.06, p<.01, and fewer submissive laughs, b=-.53, CI_{95}(-.74, -.31), t=-4.79, p<.01, than targets (see Figure 2).

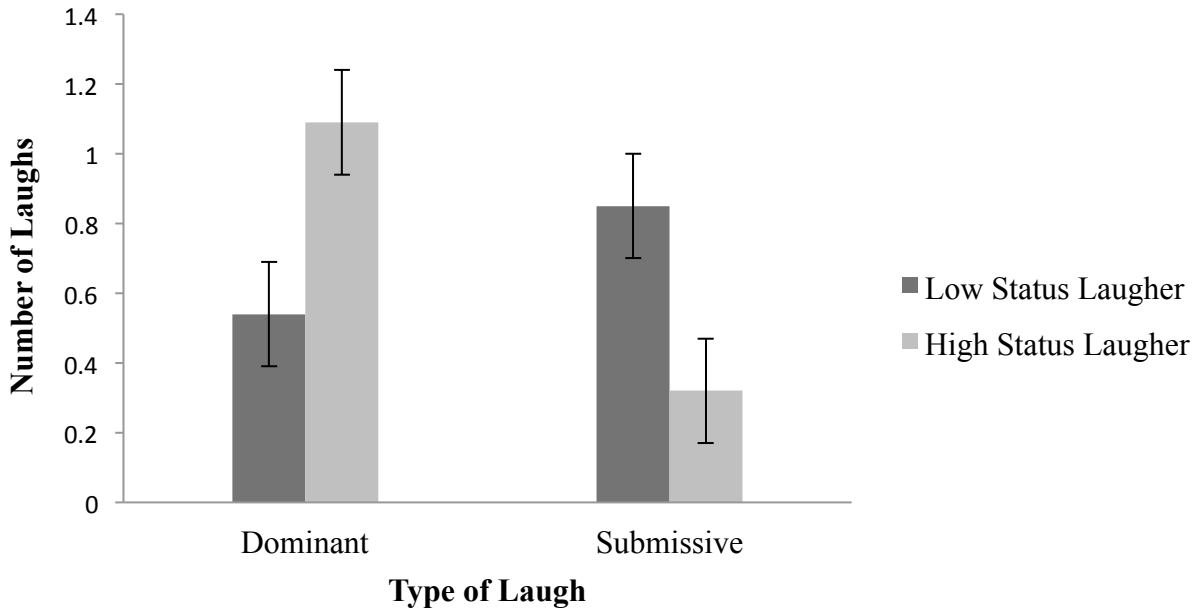


Figure 1. Number of dominant and submissive laughs per conversation in Study 1 by laugher status. Error bars depict +/-1 standard error.

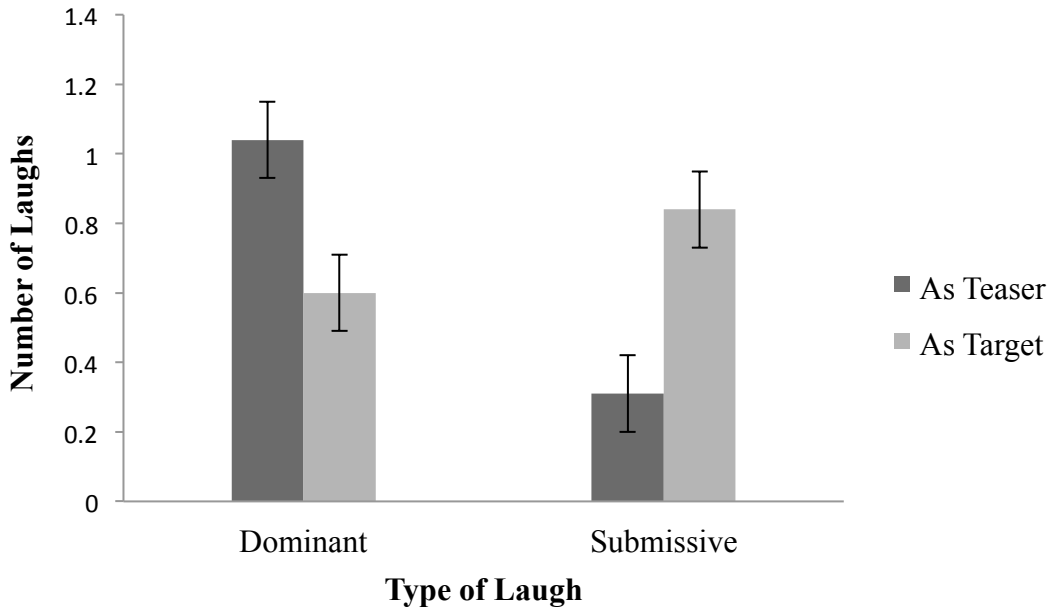


Figure 2. Number of dominant and submissive laughs per conversation in Study 1 by context (teaser versus target). Error bars depict +/-1 standard error.

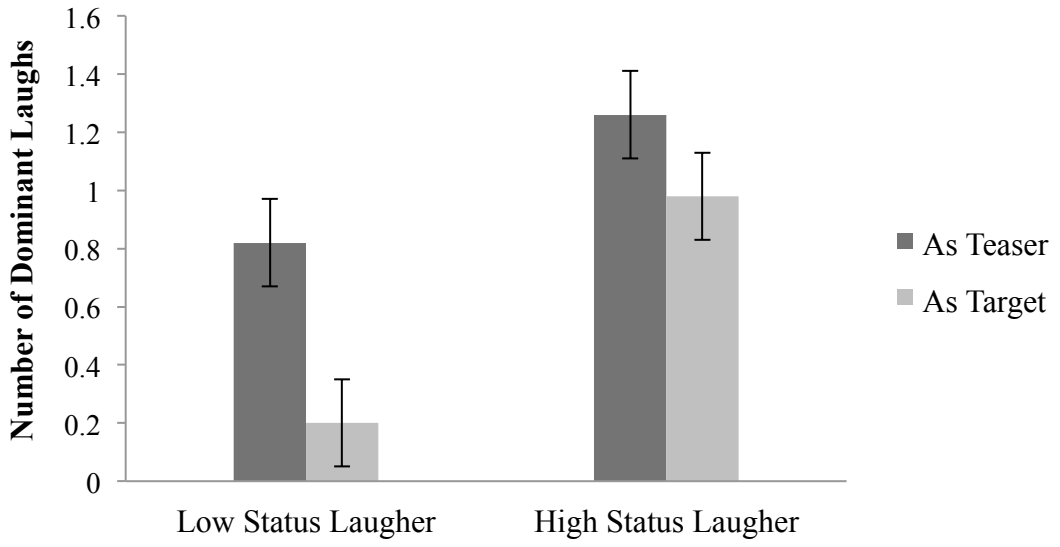
Low-Status Laughers Vary Their Laugh Type Between Roles

Our final analyses examined how status and role interacted in influencing laughter. We predicted that low-status individuals would display more variation in behavior between teaser and target contexts than high-status individuals. Here, the target versus teaser dummy variable was a level-1 predictor, status was a level-2 moderator of the target versus teaser variable, and total number of laughs was a level-1 control predictor. Consistent with our hypothesis, low-status laughers showed greater differences than did high-status laughers between the teaser and target contexts in number of dominant, b=-.34, CI_{95}(-.73, .05), t=-1.72, p=.09, and submissive laughs, b=.61, CI_{95}(.22, 1.00), t=3.04, p<.01. Low-status individuals laughed dominantly 393% more as teasers than as targets, b=.62, CI_{95}(.33,.91), t=4.21, p<.01, and laughed submissively 301% more as targets than as teasers, b=-.84, CI_{95}(-1.12, -.55), t=-5.46, p<.01 (see Figure 3). In contrast, high-status individuals laughed dominantly 28% more as teasers than as targets, b=.27, CI_{95}(-.01, .56), t=1.88, p=.06, and laughed submissively 99% more as targets than as teasers, b=-.23, CI_{95}(-.51, .06), t=-1.56, p=.12. Status and role did not interact in predicting total number of laughs, b=.07, CI_{95}(-.74, .86), t(283)=.17, p=.865.

Study 2

Study 1 provided the first evidence that status influences how individuals laugh. High-status individuals produced more dominant laughs, and low-status individuals produced more submissive laughs. In addition, low-status individuals were more likely to change the form of their laughter based on power-shifting context. In Study 2, we examined whether unacquainted observers detect status cues in laughter. If so, this may explain why low-status individuals are more likely to alter their laughter when the context allows.

Panel A: Number of dominant laughs per conversation



Panel B: Number of submissive laughs per conversation

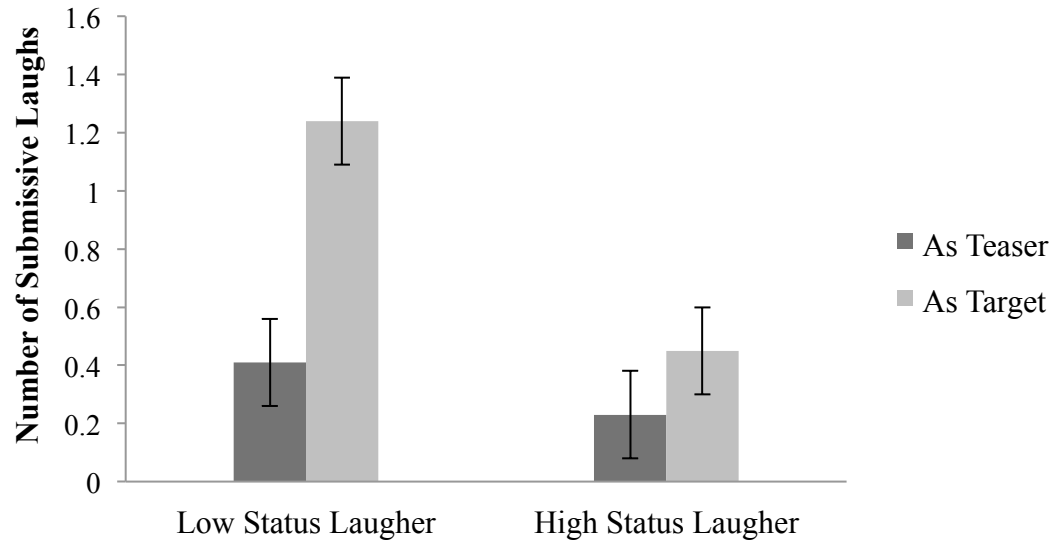


Figure 3. Number of dominant (Panel A) and submissive (Panel B) laughs in Study 1 by context (teaser versus target) and status of the laugher. Error bars depict +/-1 standard error.

The thin-slicing literature (Weisbuch & Ambady, 2011) demonstrates that social inferences are made based on very brief samples (i.e., "thin slices") of behavior. Independent raters achieve consensus (Albright, Kenny, & Malloy, 1988; Norman & Goldberg, 1966) and are quite accurate (Ambady & Rosenthal, 1992; Levesque & Kenny, 1993) when judging others based on these "thin slices" of behavior. We applied the thin-slicing technique in Study 2 to determine if the way individuals laugh influences their perceived status in the eyes of others. Here, participants listened to a single dominant or submissive laugh from 20 fraternity members from Study 1 and estimated the status of each laugher. First, we were interested in accuracy: how well strangers could discern status from listening to a single laugh. Second, we were interested in how social perceptions of status were influenced by dominant versus submissive laughs. Finally, following Bachorowski & Owren (2001), we were interested in determining if the emotions elicited by particular types of laughs could help explain the influence of laugh type on perceived status.

Method

Participants and Procedure

Fifty-one undergraduates (51.9% female) from a U.S. public university were randomly assigned to hear laughs and rate the status of each laugher in a 2 (laugher status) x 2 (dominant versus submissive laugh) mixed-subjects design. Twenty fraternity brothers (10 high-status, 10 low-status) from Study 1 produced at least one dominant and one submissive laugh, and we randomly selected a single dominant laugh and a single submissive laugh from each of them for use in Study 2. Two counterbalanced, randomized orders were employed so half of the participants heard a particular laugher laughing dominantly, whereas the other half heard that same laugher laughing submissively. Each participant thus heard 20 laughs, each from a different

person: five dominant laughs from high-status laughers, five submissive laughs from high-status laughers, five dominant laughs from low-status laughers, and five submissive laughs from low-status laughers. Participants were told they would be listening to laughs from members of a social group. After hearing each laugh, they made status and emotion ratings as detailed below.

Status Perceptions

After listening to each laugh, participants estimated the laugher's status (1=*very low*, 9=*very high*), respect from other group members (1=*very little*, 9=*very much*), and influence (1=*very little*, 9=*very much*). These three ratings were averaged to create a status composite (α=.98).

Emotional Experience

In exploratory fashion, we were interested in whether the emotions induced in the perceiver by each laugh accounted for some variance in status ratings. After the status ratings, participants rated the valence of their current emotional experience by indicating how they currently felt (1=*very negative*, 9=*very positive*). Participants also rated their current experience of four positive (*happy, content, joyful, proud*; α=.87) and six negative emotions (*angry, sad, resentful, embarrassed, rejected, contempt*; α=.83) in a single randomized order on 1 (*very little or not at all*) to 9 (*very much*) scales. We averaged the latter two sets of ratings to retain separate positive and negative emotion scales.

Results

We first created two average perceived status scores for each laugher: one when laughing dominantly, and one when laughing submissively. Because we presented a dominant and submissive laugh for each laugher, the perceived status scores for these two types of laughs for each laugher were not independent. Thus, we used a two-level HLM model with laughs (level 1)

nested within laugher (level 2). Laugh type was entered as a level-1 predictor and laugher status as a level-2 predictor.

Laughter Influences Perceived Status

We first tested whether naïve observers, based on the sound of a single laugh, conferred higher status on high-status laughers. There was no main effect of laugher status, b=.24, CI_{95}(-.30, .80), t=.82, p=.38.

We next tested whether naïve observers conferred higher status upon laughers producing dominant versus submissive laughs. Indeed, laughers producing dominant laughs were perceived to be significantly higher in status than laughers producing submissive laughs, b=.57, CI_{95}(.06, 1.08), t=2.70, p=.01. Thus, the type of laugh significantly influenced ratings of status, whereas the actual status of the laugher did not.

Low-Status Laughers Shift Perceptions of their Status through Dominant and Submissive Laughs

Finally, we tested the interaction of laugher status with laugh type in influencing observer perceptions of a laugher's status. This interaction did not reach conventional levels of significance, b=-.66, CI_{95}(-1.67, .34), t=-1.63, p=.12, likely due to the small sample size at the laugher level. We found that the difference in perceived status as a function of laugh type was smaller among high-status laughers than low-status laughers (see Figure 4). Simple slope analyses revealed that low-status laughers were perceived to be significantly higher in status when laughing dominantly than when laughing submissively, b=.90, CI_{95}(.18, 1.58), t=3.14, p<.01, but this was not true of high-status laughers, b=.24, CI_{95}(-.45, .93), t=.84, p=.41. The above simple slope effects indicate there were meaningful differences in how low- versus high-status laughers were perceived by naïve observers as a function of laugh type.

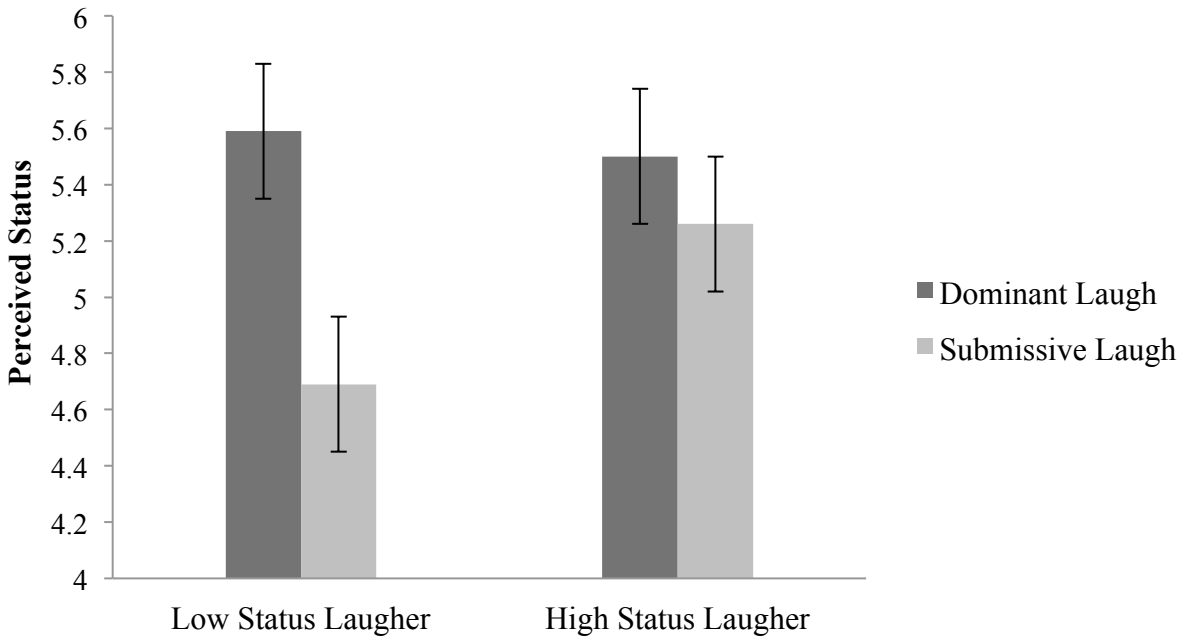


Figure 4. Perceived status in Study 2 by laugh type and status of the laugher. Error bars depict +/-1 standard error.

Emotional Experience as a Mediator of the Influence of Laugh Type on Status Perceptions

We used the three measures of emotional experience (overall valence, positive emotion, and negative emotion) to investigate whether our data were consistent with mediation models in which the influence of laugh type on status perceptions is mediated by emotional experience. First, we examined overall valence of emotional experience as a potential mediator. Laugh type positively predicted valence, b=.37, CI_{95}(.07, .66), t=2.51, p=.02. When we included both valence and laugh type as predictors of perceived status, valence had a positive effect, b=1.13, CI_{95}(.74, 1.51), t=5.69, p<.01, whereas the effect of laugh type became nonsignificant, b=.20, CI_{95}(-.23, .55), t=.82, p=.42. We tested the indirect effect using a 5000 sample bootstrapping mediation test (following Preacher & Selig, 2010) and found a significant indirect effect of

valence in this mediation model, CI_{95}(.04, .69), p<.05. Thus, our data are consistent with a model in which the influence of laugh type on status perceptions is mediated by the overall valence of emotional experience.

We next decomposed this into positive and negative emotional experience separately and examined positive emotional experience as a potential mediator. Laugh type marginally predicted positive emotion, b=.29, CI_{95}(.00, .59), t=1.95, p=.058. When we included both positive emotion and laugh type as predictors of perceived status, positive emotion had a positive effect, b=1.07, CI_{95}(.68, 1.47), t=5.33, p<.01, whereas the effect of laugh type became nonsignificant, b=.26, CI_{95}(-.09, .61), t=1.43, p=.17. We tested the indirect effect using a 5000 sample bootstrapping mediation test and found a marginally significant indirect effect of positive emotion in this mediation model, CI_{95}(.00, .68), p=.05. These data are consistent with a model in which the influence of laugh type on status perceptions is mediated by positive emotional experience.

Finally, we examined negative emotional experience as a potential mediator. Laugh type was not significantly related to negative emotion, b=-.05, CI_{95}(-.17, .06), t=-.95, p=.35. When we included both negative emotion and laugh type as predictors of perceived status, negative emotion had a marginally significant negative effect, b=-1.10, CI_{95}(-1.80, -.31), t=1.76, p=.09, and the effect of laugh type remained significant, b=.52, CI_{95}(.10, .92), t=2.46, p=.02. We did not find a significant indirect effect of negative emotion in this mediation model, CI_{95}(-.07, .25), p=.38. Thus, our data are not consistent with a model in which the influence of laugh type on status perceptions is mediated by negative emotional experience.

Together, these findings suggest that the emotional reactions of observers of laughter, particularly their positive emotions, can help explain the link between laugh type and status perceptions.

Discussion

The present studies demonstrate for the first time that status is conveyed in how individuals laugh. In Study 1, status influenced the form, but not the overall amount, of a person's laughter. High-status individuals displayed more dominant laughs, whereas low-status individuals displayed more submissive laughs. Trained coders rated these dominant laughs as possessing more disinhibited characteristics than submissive laughs. Further, Study 1 demonstrated that aggressors (i.e., teasers) produce more dominant laughs, whereas targets of aggression produce more submissive laughs.

However, low- and high-status individuals were not equally affected by the context of these roles. Low-status individuals were more likely to alter their behavior to fit the context, producing more dominant and fewer submissive laughs when they were the aggressor versus the target (although the interaction term for dominant laughs did not reach conventional levels of significance). Meanwhile, high-status individuals displayed generally high levels of dominant laughs and low levels of submissive laughs, regardless of their role. This greater situational tuning of low-status participants fits our predictions and various theories (e.g., Keltner et al., 2003; Magee & Smith, 2013).

Given that exaggerating one's status leads to less social acceptance (Anderson et al., 2006), it is notable that low-status participants produced more dominant laughs when acting as teaser. We suggest that low-status individuals may strategically use dominant laughter when it is warranted (i.e., when in the position of aggressor) to influence others' perceptions of their own

status. After all, the desire for status is a fundamental human motive (Anderson et al., 2015), so it is logical they would seize the opportunity to gain status when it might be justified. As Study 2 demonstrated, this strategy is likely to succeed: When participants displayed a dominant laugh, they were perceived as having higher status. This was particularly true for low-status individuals, who were rated as significantly higher in status when displaying a dominant versus submissive laugh. Thus, by strategically displaying more dominant laughter when the context allows, low-status individuals may achieve higher status in the eyes of others.

However, laugh type did not affect perceptions of high-status laughers. Regardless of whether perceivers heard a dominant or a submissive laugh from a high-status individual, they rated that person as being relatively high in status. In this way, the findings from Study 2 both extend thin-slicing studies to the domain of laughter, and point to a critical moderator of when social perception through laughter is likely to be more accurate. We can only speculate as to why judgments of status for high-status individuals did not change with laugh type. One possibility is that even the submissive laughs of high-status individuals possessed characteristics conveying higher status that were unmeasured in the present research. Relatedly, it is possible that the submissive laughs of high status individuals were not very convincing, consistent with their relatively lower degree of situational tuning in Study 1. Our analyses suggest that positive emotional responses of perceivers explain part of the relationship between laugh type and status perceptions. Future research should explore additional qualities of dominant and submissive laughs from low- versus high-status individuals and use different contexts to elicit a broader range of laughs from both groups.

The present studies contribute to the literature on status and nonverbal behavior by demonstrating that high- and low-status individuals laugh in qualitatively different ways. Many

of these differences reflect the more disinhibited nature of dominant versus submissive laughs (e.g., Keltner et al., 2003). It is notable that dominant laughs were higher in pitch than submissive laughs, in line with recent research showing that higher-ranked individuals had higher-pitched voices than lower-ranked individuals, and that perceivers associated higher-pitched voices more with high than low rank (Ko et al, 2015). Alternatively, this result may reflect the unique nature of the relationship between laughter and status. The characteristics that make a voice seem lower or higher in status may not be the same characteristics that make a laugh seem lower or higher in status. For example, we found that dominant laughs were more variable in pitch than submissive laughs, whereas both Ko et al. (2015) and Hall et al. (2005) found that high-rank voices were less variable than low-rank voices. Thus, the present research moves beyond a mere proof of existence of a relationship between laughter and status, demonstrating how the nature of this relationship differs from that of the relationship between status and other vocal nonverbal behaviors.

Importantly, these results were obtained in ecologically valid samples of naturally occurring laughter, documenting the broader property of laughter as a signal of social information, and suggesting that laughter shapes social interactions and alters group dynamics. The present findings also contribute to a burgeoning literature on the factors that influence social perceptions of status (e.g., Leary, Jongman-Sereno, & Diebels, 2014). While Study 2 demonstrated that a single laugh can influence perceptions of status, the results of Study 1 suggest that status may also be communicated through the relative frequency of dominant and submissive laughter.

We must also acknowledge some limitations of the present studies. First, although we focused on the fraternity members in Study 1 as differing in status, they also differed in power.

That is, the senior members had control over the outcome of an important part of the pledges' lives—the pledging process—but the pledges did not have much (if any) control over senior members' outcomes. Nevertheless, since power and status were perfectly correlated in our sample (i.e., high-status brothers were also high in power), and Keltner et al.'s (2003) approach-inhibition theory makes similar predictions for power and status, our hypotheses would not change if we focused on power differences rather than status differences.

If power differences were salient for participants, they may have found it inappropriate for a high-power participant to play the role of target, or a low-power participant to play the role of teaser. Past research has found that individuals who feel their high-power role is inappropriate or illegitimate tend to be more inhibited, whereas individuals who feel their low-power role is illegitimate tend to be more disinhibited (Lammers, Galinsky, Gordijn, & Otten, 2008). Applied to Study 1, this would predict that pledges would exhibit more submissive laughter when in the role of teaser, and senior brothers would exhibit more dominant laughter when in the role of target. This was not the case. Future research should include measures of the degree to which participants find the roles of teaser versus target to be comfortable, legitimate, and appropriate to explore these relationships further.

Another limitation of Study 1 is that all participants were male members of an organization that emphasizes masculinity. Future research should involve female participants to determine if laughter's relationship to status is gender specific. Females laugh more than males (Chapell et al., 2002; Provine, 1993), but men may use laughter differently than women to negotiate dominance and status, at least in same-sex groups (Mehu & Dunbar, 2008).

Finally, the initial coding of laughs as dominant versus submissive in Study 1 was done with both visual and auditory input available, meaning it is unclear how much coders relied on

each type of information when making judgments. When the same laughs were coded for acoustic cues, those coders only heard audio, and significant differences between dominant and submissive laughs were found for all cues, giving us confidence in the initial dominant/submissive coding. Nonetheless, future research should attempt to distinguish between visual and auditory cues of dominance in laughter.

Direct displays of dominance can disrupt mutual bonds of cooperation that in our evolutionary past have been essential for survival. For this reason, humans, in the pursuit of peaceful cooperation and co-habitation, have developed indirect signals that change the meaning of direct dominant or submissive displays (Brown & Levinson, 1987). As the present studies reveal, laughter is likely one such signal. Laughter is one of the most ubiquitous social behaviors; its presence signals safety, play, and cooperation (e.g., Grammer, 1990; Grammer & Eibl-Eibesfeldt, 1990). But, as the present studies reveal, people also use laughter to signal and detect social status. Laughter provides the context to negotiate rank differences in hierarchical relationships by altering nonverbal dominant and submissive displays in ways that may promote smoother social interactions. As the present studies demonstrate, laughter does not simply function to communicate pleasure, joy, and the experience of humor; it also expresses dominance, negotiates rank, and reveals status.

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Footnotes

[1] Only one finding was slightly different (co-occurrence) when running the models with the focal level-1 predictor as random; thus, the effects appear robust regardless of fixed/random decision.

[2] We focused on the relative frequency of dominant and submissive laughter rather than the absolute number, which can be heavily influenced by total amount of laughter. For instance, suppose Raul as teaser exhibits 5 dominant laughs, 0 submissive laughs, and 0 other laughs; then, as target, he exhibits 5 dominant laughs, 10 submissive laughs, and 10 other laughs. An analysis that does not account for total laughter would indicate no difference in the production of dominant laughs between roles. An analysis that controls for total laughter would identify that there is relatively more dominant laughter as teaser than as target.

Supplemental Materials

Additional analyses of nicknames from Study 1

Given the pre-existing status differences among fraternity members, we attempted to determine if the nature of the teasing varied by the status of the teaser, the target, and/or their interaction. Two coders (blind to all hypotheses and to the status of the participants) rated all nicknames (using the text of the nicknames only) on five dimensions on 1 to 7 scales: how overall negative/positive (1=very negative, 7=very positive), how harsh (1=not at all harsh, 7=very harsh), how insulting (1=not at all insulting, 7=very insulting), how complimentary (1=not at all complimentary, 7=very complimentary), and how flattering (1=not at all flattering, 7=very flattering). The two coders overlapped on 100% of the nicknames and acceptable inter-rater reliability levels were achieved between coders for all 5 nickname content dimensions: negative/positive (alpha=.71), harsh (alpha=.74), insulting (alpha=.79), complimentary (alpha=.73), and flattering (alpha=.73). Three variables were retained as per our a priori plans. The negative/positive item was analyzed by itself as a measure of overall valence (alpha=0.71) of the nickname. The harsh and insulting items were averaged to form a harshness composite (inter-item alpha=.90), and the flattering and complimentary items were averaged to form a flattery composite (inter-item alpha=.91).

Our analyses of the nicknames looked for effects of teaser status (low vs. high), target status (low vs. high), and their interaction on overall valence, the harshness composite, and the flattery composite. To account for the nested, non-independent nature of the data, two-level hierarchical linear models were employed for all analyses within R statistics using the lme4 (Bates & Maechler, 2009) and lmerTest (Kuznetsova, Brockhoff, & Christensen, 2015) packages. We created a dummy variable that compared the status of teasers and targets in a two-level structure with teasers (level 1) nested in groups (level 2). In each model, the ratings of the nickname was the outcome (valence, flattery composite or harsh composite) and status of the teaser (high=1, low=0) and the target (high = 1, low = 0) were fixed predictors run simultaneously with their interaction. No effects were significant, all *p*s>.20. Status did not exert any significant main effects on the valence of nicknames, flattery composite or harsh composite for either targets or teasers. High- and low-status teasers did not significantly differ in valence (M_H=3.24, M_L=3.46; *b*=-.20, CI_{95}(-.71, .31), *t*=-.78, *p*=.45), the flattery composite (M_H=1.56, M_L=1.96; *b*=-.39, CI_{95}(-.98, .20), *t*=-1.28, *p*=.20) nor the harsh composite (M_H=2.84, M_L=2.57; *b*=-.01, CI_{95}(-.69, .68), *t*=-.015, *p*=.99). High- and low-status targets also did not significantly differ in valance (M_H=3.28, M_L=3.37; *b*=-.06, CI_{95}(-.57, .45), *t*=-.24, *p*=.81), flattery composite (M_H=1.77, M_L=1.74; *b*=-.06, CI_{95}(-.66, .53), *t*=-.21, *p*=.84), nor harsh composite (M_H=2.69, M_L=2.72; *b*=-.22, CI_{95}(-.92, .46), *t*=-.65, *p*=.52). No significant interactions emerged between teaser status and target status on valence (*b*=-.14, CI_{95}(-.85, .59), *t*=-.37,*p*=.72), flattery composite (*b*=-.10, CI_{95}(-.94, .74), *t*=-.23, *p*=.82) or harsh composite (*b*=.60, CI_{95}(-.37, 1.57), *t*=1.20, *p*=.23) of nicknames.

Additional analyses of the acoustic features of high- versus low-status participants' laughs in Study 1

In the present paper, our conceptual analysis focuses on how high- versus low-status can promote the productive of discrete types of laughs. We theorized that status would influence the

relative production of amounts of discrete types of laughs (dominant versus submissive), rather than producing global effects on laugh prosody. Thus, the analyses in the main text focus on analyses that investigate these hypotheses, and we found consistent evidence: Status (as well as teaser vs. target role) influenced the production of dominant versus submissive laughs, which were distinguishable based on their acoustic features.

Here, in the supplemental materials, we provide exploratory analyses to address an interesting tangential question: Do status, teaser vs. target role, and/or the interaction of these factors produce global effects on laugh acoustics? In general, we did not find much evidence in support of global effects on laugh acoustics in the teasing paradigm in Study 1.

Our analyses of laugh acoustics looked for effects of laugher status (low vs. high) on the acoustic properties of an individual's laugh. We created a dummy variable that compared the status of laughers in a two-level structure with individuals (level 1) nested within groups (level 2). In each model, acoustic property was the outcome and status of the laugher (high=1, low=0) was a level-1 fixed predictor. Status did not exert any significant main effects on laugh acoustics. High- and low-status laughers did not significantly differ in vocal intensity (M_H=2.72, M_L=2.10; b=.49, CI_{95}(.-.03, 1.01), t=1.90, p=.066), pitch (M_H=3.06, M_L=2.39; b=.58, CI_{95}(-.02,1.18), t=1.91, p=.066), pitch range (M_H=1.33, M_L=.93; b=.32, CI_{95}(-.05,.68), t=1.72, p=.093), pitch modulation (M_H=1.24, M_L=.83; b=.32, CI_{95}(-.01,.64), t=1.93, p=.060), airiness (M_H=4.04, M_L=4.56; b=-.49, CI_{95}(-1.13,.15), t=-1.56, p=.136), burst speed (M_H=1.90, M_L=1.42; b=.38, CI_{95}(-.02,.78), t=1.89, p=.068), nor co-occurrence (M_H=.84, M_L=.76; b=.07, CI_{95}(-.03,.16), t=1.40, p=.171).

We also looked for effects of the role of teaser vs. target on acoustic properties of an individual's laugh. We created a dummy variable that compared the role of individuals in a two-level structure with individuals (level 1) nested within groups (level 2). In each model, acoustic property was the outcome and role of the individual (teaser = 1, target = 0) was a level-1 fixed predictor. The role of teaser vs. target exerted a main effect only on the airiness of the laugh, (M_{Teaser}=3.94, M_{Target}=4.47; b=-.43, CI_{95}(-.85,-.01), t=-2.023, p=.04). Teasers and targets did not significantly differ in vocal intensity (M_{Teaser}=2.62, M_{Target}=2.30; b=.23, CI_{95}(-.18, .64), t=1.09, p=.28), pitch (M_{Teaser}=3.08, M_{Target}=2.55; b=.39, CI_{95}(-.02, .81), t=1.86, p=.06), pitch range (M_{Teaser}=1.18, M_{Target}=1.10; b=.07, CI_{95}(-.15, .29), t=.64, p=.52),pitch modulation (M_{Teaser}=1.12, M_{Target}=.99; b=.12, CI_{95}(-.07, .31), t=1.19, p=.24), burst speed (M_{Teaser}=1.57, M_{Target}=1.70; b=-.19, CI_{95}(-.49, .10), t=-1.31, p=.19), nor co-occurrence (M_{Teaser}=.83, M_{Target}=.78; b=.03, CI_{95}(-.06, .11), t=.59, p=.56).

One significant interaction emerged: Status and Teaser vs. Target role interacted in their influence on the burst speed of laughs (b=1.15, CI_{95}(.58, 1.71), t=3.96, p<.001). Low-status individuals show significant differences between the teaser and target context (b=.84, CI_{95}(.44, 1.23), t=4.18, p<.001), but high-status individuals do not (b=-.28, CI_{95}(-.69, .12), t=-1.39, p=.167). Teasers are significantly impacted by their status (b=1.17, CI_{95}(.67, 1.65), t=4.71, p<.001), but targets are not (b=.05, CI_{95}(-.49, .59), t=.20, p=.845). These effects are illustrated in the table below.

	Teaser	Target
Low Status	.93	1.63
High Status	2.1	1.78

No other significant interactions were found: there was no significant interaction on vocal intensity (b=-.29, CI_{95}(-1.06, .48), t=-.75, p=.46), pitch (b=0.00, CI_{95}(-.83, .84), t=-.01, p=.992), pitch range (b=.04, CI_{95}(-.39, .47), t=.17, p=.87), pitch modulation (b=-.01, CI_{95}(-.39, .38), t=0.05, p=.96), airiness (b=.59, CI_{95}(-.26, 1.42), t=1.38, p=.17), nor co-occurrence (b=.01, CI_{95}(-.16, .18), t=.13, p=.90).