

**TWO WAYS TO THE TOP:
EVIDENCE THAT DOMINANCE AND PRESTIGE ARE DISTINCT YET VIABLE
AVENUES TO SOCIAL RANK**

by

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Abstract

The pursuit of social rank is a recurrent and pervasive challenge faced by individuals in all human societies. Yet, the precise means through which individuals compete for social standing remains unclear. Chapters 2 and 3 addressed this question and examined the impact of two fundamental strategies—*Dominance* (the use of force and intimidation to induce fear) and *Prestige* (the sharing of expertise or know-how to gain respect)—on the attainment of social rank, among a group of individuals who interacted over a collaborative group task. Consistent with this theoretical framework, the adoption of either a Dominance or Prestige strategy promoted perceptions of greater influence as rated by both group members and outside observers, higher levels of actual impact over the group's decision-making (Chapter 2), and increased visual attention from observers whose gaze was monitored with an eye-tracking device (Chapter 3). Subsequent studies explored the ethological underpinnings of these rank-attaining strategies by examining the verbal styles and nonverbal behaviors displayed by Dominant and Prestigious individuals during the group interactions. Detailed behavioral coding revealed that whereas Dominance was signaled through intimidating and self-entitling verbal styles and spatially expansive and aggressive postural displays, Prestige was signaled through socially attractive and self-deprecating verbal styles and confidence-signaling nonverbal movements (Chapters 4-5). Furthermore, Dominant individuals signaled their formidability by lowering their vocal pitch during the initial minutes of the group interaction (Chapter 6). In contrast, Prestige was not systematically associated with alterations in pitch. Collectively, these studies demonstrate that Dominance and Prestige are independent yet both viable strategies for ascending the social

hierarchy, and are each underpinned by distinct, theoretically predictable patterns of verbal styles and nonverbal behaviors.

Preface

Chapter 1 was drafted by me, with intellectual contributions from J. Tracy and J. Henrich.

Chapters 2 and 3 are based on work conducted in UBC's Emotion and Self Lab, Culture Cognition and Coevolution Lab, and Brain and Attention Research Lab, by myself, J. Tracy, T. Foulsham, A. Kingstone, and J. Henrich. All individuals involved designed the research, T. Foulsham and I supervised data collection, I analyzed data, and drafted these chapters. J. Tracy, A. Kingstone, and J. Henrich provided intellectual contributions. A version of these two chapters has been published in: Cheng, J. T., Tracy, J. L., Foulsham, T., Kingstone, A., & Henrich, J. (2013). Two ways to the top: Evidence that dominance and prestige are distinct yet viable avenues to social rank and influence. *Journal of Personality and Social Psychology*, 104(1), 103–125. doi:10.1037/a0030398.

Chapters 4 and 5 are based on work conducted in the Emotion and Self Lab and the Culture Cognition and Coevolution Lab, in collaboration with J. Tracy and J. Henrich. As the primary contributor, I designed the studies, supervised data collection and coding, analyzed all data, and drafted the chapters.

Chapter 6 contains research conducted in the Emotion and Self Lab and the Culture Cognition and Coevolution Lab, in collaboration with J. Tracy, S. Ho, and J. Henrich. I was the primary contributor of this work. Specifically, I was responsible for the methodological design, supervision of data collection, and data analysis. J. Tracy, S. Ho, and J. Henrich provided intellectual contributions. A version of this chapter has been submitted for publication: Cheng, J. T., Tracy, J. L., Ho, S., & Henrich, J. (under review). Listen, follow me: Changes in vocal pitch predict social rank.

Chapter 7 was drafted by me, with intellectual contributions from J. Tracy and J. Henrich.

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Chapter 1: Introduction

Men are driven by two principal impulses, either by love or by fear.

--Niccolò Machiavelli, *The Discourses*

*It is better to be both feared and loved, however,
if one cannot be both it is better to be feared than loved.*

--Niccolò Machiavelli, *The Prince*

Five hundred years ago, Niccolò Machiavelli penned *The Prince*, which, to this day, remains one of the most influential and controversial books in Western literature. In his political treatise, Machiavelli famously advocated that, when it comes to leadership and maintaining political influence, the ends always justify the means, regardless of how immoral. He asserted that the most effective means to lead and influence is to instill both fear and love or respect, and that, in fact, fear is better than love. This seemingly immoral principle has been the subject of considerable debate, and many philosophers today continue to regard Machiavelli's belief system as synonymous with inhumane and manipulative tyranny, and consider it a recipe for ineffective and destructive leadership (e.g., Croce, 1946). However, many others suggest that Machiavelli's writings in fact articulate a realistic portrait of leadership success ("Jared Diamond," 2013).

Lending credence to this view, history supplies numerous examples of leaders who appear to lead successfully by instilling fear, as well as examples of those who lead successfully by attaining respect. To take one example, Henry Ford II—grandson of Henry Ford, founder of

Ford Motor Company—built Ford into the second largest industrial corporation worldwide between 1945 and 1980, amidst a turbulent post World War II economy. Ford II attained his success, in part, by developing a reputation for erratic outbursts of temper and unleashing humiliation and punishment at will upon his employees, who described him as a terrorizing dictator, bigot, and hypocrite. When challenged or questioned by subordinates, Ford II would famously remind those who dared contradict him, “My name is on the building”. Yet, despite being widely regarded as one of the most intimidating and autocratic CEOs to ever grace the company, Ford II was an enormously successful leader, and has been credited with reviving the Ford business legend during a period of turmoil and crisis (Iacocca, 1984).

A contrasting example of effective leadership can be seen in Warren Buffett, chairman and CEO of Berkshire Hathaway (BH), who was ranked the world’s wealthiest person in 2008, and third wealthiest in 2011. Widely regarded as one of the most skilled and successful investors, and referred to as “the sage and oracle of Omaha”, Buffett is extraordinarily respected by business leaders, who regularly travel to his BH headquarters in Nebraska to seek his wisdom. Buffett’s prestige extends well beyond the business and investment realm; in 2011, he was ranked one of the top five most admired and respected men in the world (Jones, 2011). Under his leadership, BH has consistently emerged as one of the most highly regarded U.S. companies, according to public polls (Malone, 2010). Despite this high level of success, Buffet exemplifies a markedly different leadership style from that of Ford II. Buffett has developed a reputation for subtly steering rather than controlling every decision-making process, and is known to demonstrate trust and respect towards his executives. The fact that both these men reached what can only be considered the highest pinnacle of social rank possible in any industry, yet did so using highly divergent approaches to leadership, raises the question: Are there multiple ways of

ascending the social hierarchy in human societies? Was Machiavelli's advice to rule through both fear and love sage?

This dissertation addresses these questions by examining the efficacy of two fundamental strategies—*Dominance* (the use of force and intimidation to induce fear) and *Prestige* (the sharing of expertise or know-how to gain respect)—for attaining social rank. Further, I explore how these strategies manifest ethologically, by identifying the suite of verbal styles and nonverbal behaviors that underlie each. Overall, by investigating the psychological and behavioral processes that underlie the formation of social hierarchies, the current research contributes to the scientific understanding of human social rank dynamics.

1.1 The Nature of Social Hierarchy

Hierarchical differences, defined as the “rank order of individuals or groups on a valued social dimension” (Magee & Galinsky, 2008, p. 354), are a universal feature of social groups (Brown, 1991; Mazur, 1985; Murdock, 1949). In all human societies, hierarchical differences among individuals influence patterns of conflict, resource allocation, and mating, and often facilitate coordination on group tasks (Báles, 1950; Berger, Rosenholtz, & Zelditch, 1980; Ellis, 1995; Fried, 1967; Kwaadsteniet & van Dijk, 2010; Ronay, Greenaway, Anicich, & Galinsky, 2012). Even the most egalitarian of foragers reveal such rank differences, despite the frequent presence of social norms that partially suppress them (Boehm, 1993; Lee, 1979; Lewis, 1974; see Henrich & Gil-White 2001). High-ranking individuals tend to have disproportionate influence within a group, such that social rank can be defined as the degree of influence one possesses over resource allocation, conflicts, and group decisions (Berger et al., 1980). In contrast, low-ranking individuals must give up these benefits, deferring to higher ranking group members. As a result,

higher social rank tends to promote greater fitness than low-rank, and a large body of evidence attests to a strong relation between social rank and fitness or well-being, across species (e.g., Barkow, 1975; Betzig, 1986; Cowlshaw & Dunbar, 1991; Hill, 1984a; Hill & Hurtado, 1989; von Rueden, Gurven, & Kaplan, 2011; Sapolsky, 2005).

Despite its ubiquity, the process of hierarchical differentiation in humans is not well understood, and it remains unclear precisely how individuals attain and successfully compete for social rank and influence. At least two major accounts of rank attainment currently prevail in the literature, but they are directly at odds with each other, resulting in an ongoing debate within the field (Anderson, Srivastava, Beer, Spataro, & Chatman, 2006). On one hand, a number of theorists have argued that rank acquisition relies on the attainment and demonstration of superior skills and abilities, as well as altruistic tendencies, arguing that “individuals do not attain status by bullying and intimidating... but by behaving in ways that suggest high levels of competence, generosity, and commitment” (Anderson & Kilduff, 2009a, p. 295; also see Berger, Cohen, & Zelditch, 1972; Hollander & Julian, 1969). In contrast, others argue that individuals ascend a group’s hierarchy and attain influence by using manipulative and coercive tactics such as intimidation and “aggression... [which] function to increase one’s status or power” (Buss & Duntley, 2006; p. 267), and that the human hierarchical system is at least partially “based... on overt threats and physical attack” (Mazur, 1973, p. 526; also see Chagnon, 1983; Griskevicius, Tybur, Gangestad, Perea, Shapiro, & Kenrick, 2009). In short, some hold that social ranking is determined entirely by relative competence and deny the importance of force and intimidation to rank attainment; whereas others argue that force and threat are in fact *the primary basis* of rank allocation in human societies. These perspectives are clearly incompatible, so beg some resolution. In the present dissertation, I argue that in contrast to these two opposing perspectives,

neither intimidation nor competence can be considered an exclusive means of rank-acquisition in humans. Instead, both of these processes may operate concurrently within social groups, such that individuals can pursue either path to successfully ascend the social hierarchy (Cheng, Tracy, & Henrich, 2010; Henrich & Gil-White, 2001).

I tested this novel account of rank attainment by examining whether individuals who adopt these distinct behavioral pathways emerge as high-ranking members of their social group. Specifically, in accordance with prior research, we operationalized social rank in terms of social influence (i.e., the ability to modify others' behaviors, thoughts, and feelings; Báles, Strodbeck, Mills, & Roseborough, 1951; Berger et al., 1972; Cartwright, 1959; French & Raven, 1959; Henrich & Gil-White, 2001; Magee & Galinsky, 2008; Mazur, 1973; Moore, 1968) and attention received from others (Anderson & Shirako, 2008; Chance, 1967; Fiske, 1993; Hold, 1976; see Anderson, John, Keltner, & Kring, 2001), predicting that each of the two rank-attaining strategies—Dominance and Prestige—would be associated with success in rank acquisition, and that they should each be associated with distinct ethological (i.e., behavioral) patterns.

1.2 Perspectives on Hierarchical Differentiation

A review of the literature on human social rank reveals three broad perspectives on the key determinants of social rank in human groups: the competence-based account, the conflict-based account, and the Dominance-Prestige Account. In the current section, I discuss each of these in turn.

1.2.1 The Competence-Based Account of Hierarchy Differentiation

Most accounts of social hierarchy take a competence-centered perspective (e.g., Berger et al., 1972; Blau, 1964; Hollander & Julian, 1969; Thibaut & Kelley, 1959), in which an

individual's rank is considered to be a function of the group's collective consensus on the individual's social worth. In other words, influence is conferred by the group upon individuals perceived to possess superior expertise and competence in valued domains (Berger et al., 1972). This system of rank allocation is thought to serve a number of functions, such as increasing perceptions that the hierarchy is legitimate and fair—which minimizes conflict—and allowing the group to maximize contributions from its most competent members to best achieve shared goals.

The competence-based perspective on rank attainment has garnered considerable empirical support. For example, numerous studies have demonstrated that the characteristics valued and prioritized in leaders—intelligence, competence, group commitment, and prosociality—consistently predict high rank, defined in terms of perceived influence and leadership, as well as more objective influence over group decisions (Báles et al., 1951; Coie, Dodge, & Coppotelli, 1982; Driskell, Olmstead, & Salas, 1993; Lord, De Vader, & Alliger, 1986; Strodbeck, 1951; Willer, 2009; for a review, see Anderson & Kilduff, 2009a). More specifically, studies have found that influence is granted to individuals who make high-quality comments (Gintner & Lindskold, 1975; Sorrentino & Boutillier, 1975), are perceived as experts (Bottger, 1984; Littlepage, Schmidt, Whisler, & Frost, 1995; Ridgeway, 1987), and make large contributions to a public fund (to signal their commitment and social value; Willer, 2009). In fact, Anderson and Kilduff (2009b) found that in task-focused groups, perceptions of competence were the most important contributor to social influence.

Importantly, a core principle of the competence-based account is that influence cannot be attained through coercive tactics such as bullying or intimidation, and instead derives from one's apparent value to the group (Anderson & Kilduff, 2009a; 2009b; Ridgeway, 1987; Ridgeway &

Diekema, 1989). One of the strongest proponents of this account is Barkow (1975), who argues that hierarchical relationships based purely on threat of force are untenable in human societies. This assumption is in direct opposition to the other major extant account of rank attainment within the social science literature, the conflict-based account.

1.2.2 The Conflict-Based Account of Hierarchy Differentiation

According to the conflict-based account, dominance contests (i.e., ritualized aggressive challenges, threats, or attacks resulting in the submission of one party to another) and coercion function as the most fundamental systems of rank allocation in human societies (Buss & Duntley, 2006; Chagnon, 1983; Griskevicius et al., 2009; Hill & Hurtado, 1996; Kyl-Heku & Buss, 1996; Lee & Ofshe, 1981; Mazur, 1973). In this view, rank (i.e., social influence) is allocated to individuals who show a dominant, authoritative demeanor, and not, as the competence-based perspective suggests, on the basis of rational calculation about others' abilities or expertise.

Consistent with this account, a number of studies indicate that rank is often associated with intimidation and threat; perceived influence, leadership, and actual resource control have all been found to positively correlate with coercive behavior, toughness, and various forms of aggression (Cashdan, 1998; Hawley, 2002). Results of a meta-analysis found that the personality trait of dominance—defined as a propensity towards forceful, assertive, and aggressive behaviors—explains a substantial proportion of variance in perceptions of leadership, even more so than intelligence (Lord et al., 1986). Furthermore, when asked to nominate strategies typically used for negotiating hierarchies, individuals report aggression, coercion, derogation, social exclusion, and manipulation as frequently used tactics (Buss, Gomes, Higgins, & Lauterbach, 1987; Kyl-Heku & Buss, 1996). These findings suggest that lay-individuals conceptually associate each of these two behavioral patterns with the acquisition of social rank. More broadly,

there is evidence that the motivation to seek or maintain one's rank promotes aggressive behaviors (though this research did not examine the effectiveness of these behaviors). Approximately 48% of men and 45% of women identify status/reputation concerns as the primary reason for their last act of aggression, and the experimental induction of status motives increases aggressive tendencies in both men and women (Griskevicius et al., 2009). Although there is no direct empirical evidence showing that aggression and intimidation are effective routes to attaining influence, of which we are aware, these findings are suggestive, and cannot be easily reconciled with the competence-based account.

1.2.3 The Dominance-Prestige Account of Hierarchy Differentiation

A third account of social rank acquisition, the Dominance-Prestige Account, draws on evolutionary theory to take into account our species' dual heritage as primates who tend to use coercive dominance, and as cultural beings who rely immensely on cultural learning and shared knowledge (Henrich & Gil-White, 2001). By considering the selection pressures that likely favored the emergence of hierarchical groups, Henrich and Gil-White (2001) proposed that there are two distinct paths to social rank attainment in human societies: *Dominance* and *Prestige*. *Dominance* refers to the induction of fear, through intimidation and coercion, to attain social rank, a process similar to that described by the conflict-based account. *Prestige*, in contrast, refers to social rank that is granted to individuals who are recognized and respected for their skills, success, or knowledge (which can be acquired via cultural learning), a process similar to that described by the competence-based account. The major difference between the Dominance-Prestige Account and these prior accounts is that it explicitly argues, on the basis of evolutionary logic, that *both* strategies persist in modern humans, lead to patterns of behavior and tactics that

provide effective means to social influence, and can be effective even within the same social groups and even the same individual (see below).

Dominance is exemplified by relationships based on coercion, such as that between a boss and employee, or bully and victim. Dominant individuals create fear in subordinates by unpredictably and erratically taking or threatening (implicitly or explicitly) to withhold resources or to harm their well-being; in turn, subordinates submit by complying with Dominants' demands, in order to safeguard other more valuable resources (e.g., their physical welfare, children, or livelihoods). As a result, Dominants can attain a great deal of social influence. Prestige, in contrast, is granted to individuals who are considered worthy of emulation, usually for their skills or knowledge. As a result, the opinions, wishes, and decisions of Prestigious individuals tend to be heeded, thus conferring them with high rank. The influence of Prestigious individuals is unique in that subordinates shift their views and opinions closer to that of the Prestigious (an example of emulation).

According to the model, Dominance initially arose in evolutionary history as a result of competitive contests for material resources and mates which were common among non-human species, but continues to exist in contemporary human societies, largely in the form of psychological intimidation, coercion, and wielded control over costs and benefits (e.g., access to resources, mates, and well-being). In both humans and nonhumans, Dominance hierarchies are thought to emerge to help maintain patterns of submission directed from subordinates to Dominants, thereby minimizing aggressive battles and incurred costs.

In contrast, Prestige is theorized to be unique to humans, because it is thought to have emerged from selection pressures to preferentially attend to and acquire cultural knowledge from highly skilled or successful others, a capacity considered to be less developed in other animals

(Boyd & Richerson, 1985; Laland & Galef, 2009). In this view, social learning (i.e., copying others) evolved in humans as a low-cost, fitness-maximizing information-gathering mechanism (Boyd & Richerson, 1985). Once it became adaptive to copy skilled others, a preference for social models with better-than-average information would have emerged. This would promote competition for access to the highest quality models, and deference toward these models in exchange for copying/learning opportunities. Consequently, selection likely favored Prestige differentiation, with individuals possessing high-quality information or skills elevated to the top of the hierarchy. Meanwhile, other individuals may reach the highest ranks of their group's hierarchy by wielding threat of force, regardless of the quality of their knowledge or skills. Thus, Dominance and Prestige can be thought of as coexisting avenues to attaining rank and influence within social groups, despite being underpinned by distinct motivations and behavioral patterns, and resulting in distinct patterns of imitation and deference from subordinates.

Importantly, both Dominance and Prestige are best conceptualized as cognitive and behavioral strategies (i.e., suites of subjective feelings, cognitions, motivations, and behavioral patterns that together produce certain outcomes) deployed in certain situations, and can be used (with more or less success) by any individual within a group. They are not types of *individuals*, or even, necessarily, traits within individuals. Instead, we assume that all situated dyadic relationships contain differential degrees of both Dominance and Prestige, such that each person is simultaneously Dominant and Prestigious to some extent, to some other individual. Thus, it is possible that a high degree of Dominance *and* a high degree of Prestige may be found within the *same* individual, and may depend on who is doing the judging. For example, by controlling students' access to rewards and punishments, school teachers may exert Dominance in their relationships with some students, but simultaneously enjoy Prestige with others, if they are

respected and deferred to for their competence and wisdom. Indeed, previous studies have shown that, based on both self- and peer-ratings, Dominance and Prestige are largely independent (mean $r = -.03$; Cheng et al., 2010).

1.2.3.1 Differentiating Dominance and Prestige from Other Conceptualizations of Social Rank

Although this distinction between Dominance and Prestige is consistent with a longstanding theoretical differentiation between “power” and “status” in social psychology and sociology (see Blau, 1964; Fiske, 2010; Kemper, 2006; Magee & Galinsky, 2008; Weber, 1964), it is important to note several critical differences between the two frameworks.

First, our conceptualization of Dominance differs from power in that Dominance is relevant to contexts with and without institutionalized positions, whereas power inequalities are primarily found in groups with institutionalized hierarchies and formally appointed leaders or power holders. Power has traditionally been defined as “asymmetric control over valued resources” (Magee & Galinsky, 2008, p. 361; see also Blader & Chen, 2012; Boldry & Gaertner, 2006; Dépret & Fiske, 1993; Emerson, 1962; French & Raven, 1959; Galinsky, Gruenfeld, & Magee, 2003; Keltner, Gruenfeld, & Anderson, 2003; Lewin, 1951), consistent with an emphasis on externally endowed positions that allow one to determine rewards and punishment for others. Thus, it is not clear how power can lead to hierarchical differentiation in groups without formalized ranks (e.g., friendship groups, work groups without a predetermined leader). In these contexts, all group members share a similar degree of control over critical resources, and no single individual is typically privileged with greater power than any other (by institutional systems, such as in workplace hierarchies). Thus, power is not particularly applicable to

spontaneously forming hierarchies among groups of previously unacquainted individuals, such as those examined in the current research. In addition, although powerful individuals likely possess Dominance, given that they have asymmetric control over rewards and punishments (and thus can elicit fear), Dominant individuals do not necessarily have power, in the form of institutional control over others' reward and punishment outcomes. Furthermore, in contrast to Dominance, power cannot be considered a rank-obtaining strategy that individuals can use to ascend a social hierarchy. One either has control over resources (i.e., power) or does not, making power an outcome, but not a strategy or process that produces hierarchical differentiation (see Lewis, 2002).

Second, although Prestige is consistent with the conceptual label of “social status” in social psychology and sociology—defined as “the extent to which an individual or group is respected or admired by others” (Magee & Galinsky, 2008, p. 359; also see Anderson & Kilduff, 2009a; 2009b; Blau, 1964; Fiske, 2010; Goldhamer & Shils, 1939; Ridgeway & Walker, 1995; Zelditch, 1968)—the term Prestige is better suited for our theoretical framework because status has notably different definitions in other disciplines (including several that we explicitly draw on), leading to the potential for considerable confusion (see Table 1). In particular, in personality psychology, status refers to dominance, influence, agency, and control (Carson, 1969; Leary, 1957; Wiggins, 1979), and *not* to respect or admiration. In biology and zoology, status refers to relative physical prowess and ritualized outcomes in aggressive encounters (Rowell, 1974; Bernstein, 1981; Sapolsky, 2005; Schenkel, 1967; Rabb, Woolpy, & Ginsburg, 1967; Trivers, 1985), making it similar to Dominance. In sociobiology (the field from which evolutionary psychology originated), status has been used similarly, to refer to social dominance and physical domination (Barkow, 1975; Ellis, 1995). In contrast, Prestige is defined in a highly consistent

manner across all of these disciplines; in all cases it is conceptualized as conferred respect, honor, esteem, and social regard (Anderson et al., 2001; Anderson & Kilduff, 2009a; 2009b; Barkow, 1975; Eibl-Eibesfeldt, 1989; Goldhamer & Shils, 1939; Henrich & Gil-White, 2001; Ridgeway & Walker, 1995; Buss, 2008).

Table 1. Definitions of hierarchy-related concepts in psychology and related fields

Concept	Discipline			
	Social Psychology/Sociology ^a	Personality Psychology	Sociobiology/Biology	Evolutionary Psychology
Dominance	Not a core concept	The tendency to behave in assertive, forceful, and self-assured ways; the desire for control and influence ¹	An individual's relatively stable position in a social hierarchy resulting from his/her relative success in previous aggressive or competitive encounters with conspecifics ²	The relative degree of deference, respect, and attention an individual receives from others as a consequence of his/her perceived ability to use coercion, intimidation, and imposition (control costs & benefits) ³
Prestige	Generally not a core concept; if used, tends to be interchanged with status	Not a core concept	The relative degree of deference, respect, and attention an individual receives from others ⁴	The relative degree of deference, respect, and attention an individual receives from others as consequence of one's perceived attractiveness as a cultural model, or alliance partner ⁵
Power	The relative degree of asymmetric control or influence an individual possesses over resources, often despite resistance ⁶	Used interchangeably with dominance & status	Not a core concept	Not a core concept
Status	The relative degree to which an individual is respected or admired by others ⁷	Used interchangeably with dominance & status	Used interchangeably with dominance & power, but also infrequently with prestige	The relative degree to which an individual receives (relatively) unchallenged deference, influence, social attention, and access to valued resources ⁸ (prestige & dominance are types of status)

Note. The core concepts presented here are those that focus on differences among individuals rather than group-level differences (e.g., social dominance orientation; Sidanius & Pratto, 1999). The definitions provided aim to capture the broad and modal use of each label in the respective literature, but, of course, there exists some degree of terminological variation within each literature.

^aSocial psychology and sociology are combined here because these two fields show substantial agreement in their use of these terminologies.

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¹Anderson & Kilduff (2009b), Buss & Craik (1980), Carson (1969), Gough (1987), Jackson (1999), Leary (1957), Moskowitz (1988), Murray (1938), Wiggins (1979)

²Bernstein (1970; 1981). Fournier (2009), Hinde (1974), Jolly (1972), Maynard Smith (1974), Maynard Smith & Price (1973), Mazur (1985), Savin-Williams (1976), Strayer, Bovenkerk, & Koopman (1975), Strayer & Strayer (1976), Wilson (1975)

³ Buss (2008), Henrich & Gil-White (2001), Johnson et al. (2007), von Rueden et al. (2008; 2011)

⁴ Barkow (1975; 1989), Casimir & Rao (1995), Gilbert, Price, & Allan (1995), Hill (1984a; 1984b)

⁵ Buss (2008), Henrich & Gil-White (2001), Plourde (2008), von Rueden et al. (2008; 2011), Wood (2006)

⁶ Blader & Chen (2012), Boldry & Gaertner (2006), Dépret & Fiske (1993), Emerson (1962), French & Raven (1959), Galinsky, Gruenfeld, & Magee (2003), Keltner, Gruenfeld, & Anderson (2003); Lewin (1951), Kemper (1990; 2006), Magee & Galinsky (2008)

⁷Anderson & Kilduff (2009a; 2009b), Blau (1964), Fiske (2010), Goldhamer & Shils (1939), Magee & Galinsky (2008), Kemper (1990; 2006), Ridgeway & Walker (1995), Zelditch (1968)

⁸Henrich & Gil-White (2001), von Rueden, Gurven, & Kaplan (2008)

Third, despite their theoretical differentiation, power and status have repeatedly been found to be highly correlated, in both naturalistic and laboratory-based groups (Barth & Noel, 1972; Carli & Eagly, 1999; Guinote, Judd, & Brauer, 2002; Hewstone, Rubin, & Willis, 2002; Sidanius & Pratto, 1999). These correlations likely result from the fact that influence is a consequence of both power and status, but is conceptually distinct (Fiske & Berdahl, 2007; Magee & Galinsky, 2008). For example, one of the most frequently employed experimental manipulations of power involves real or imagined assignment to manager vs. subordinate roles. One potential problem with this manipulation is that some participants assigned the “manager” role may lead and exert influence via their ability to control rewards and punishments (i.e., power), whereas others may do so by demonstrating competence and expertise (i.e., status), and still others may choose to pursue both strategies in different relationships. Because distinctions are typically not made between these various strategies and behaviors, they become conflated, resulting in a positive correlation between power as manipulated in this manner and status as assessed via respect and admiration. In contrast, Dominance and Prestige are theoretically and empirically independent constructs, regardless of whether they are assessed with self-perceptions in the form of generalized Dominance and Prestige across a range of relationships ($r = .03$, $p = .65$), or in a specific, naturalistic context ($r = .07$, $p = .54$), or via peer-perceptions ($r = .12$, $p = .23$; see Cheng et al., 2010).

Thus, by making a clear theoretical distinction between the two strategies used to attain social rank, we can assess Dominance and Prestige as separate constructs, and avoid contamination of either with other related but still distinct constructs such as social influence. At a broader level, the use of the concepts and terminology developed in the Dominance-Prestige model allows us to maintain consistency with that model’s evolutionarily derived theory, as well

as the biological literature on primates; in contrast, labels such as power and status may be consistent with folk terminology but less theoretically grounded. For example, it is not clear how the concepts of power or status could be applied to non-human primates (e.g., baboons and chimpanzees), whereas the Dominance concept places humans firmly within the natural world. Indeed, biologists and anthropologists have developed an immense body of research on Dominance in primates and other animals (e.g., Bernstein, 1976; Eibl-Eibesfeldt, 1970; Lorenz, 1964; Mazur, 1985; Sapolsky, 2005; Schjelderup-Ebbe, 1935; de Waal, 1986), so by adopting this framework we can draw on insights from these literatures to enrich our understanding of human rank dynamics. There are a number of reasons to suspect that human Dominance shares phylogenetic continuity with Dominance patterns observed in other primates (Eibl-Eibesfeldt, 1961; Henrich and Gil-White 2001; Mazur, 1985; Tracy, Shariff, & Cheng, 2010).

Several studies of human rank dynamics have drawn on the Dominance-Prestige Account to measure these two strategies, typically as trait-like dispositions that vary among individuals, and supportive findings have emerged. First, individuals who tend to use a Dominance strategy across numerous relationships (from here on referred to as individuals high in Dominance, or Dominant individuals) tend to be aggressive, narcissistic, and Machiavellian, whereas those who tend to use a Prestige strategy across relationships (from here on referred to as individuals high in Prestige, or Prestigious individuals) tend to be socially accepted, agreeable, conscientious, and have high self-esteem (Buttermore, 2006; Cheng et al., 2010; Johnson, Burk, & Kirkpatrick, 2007). These findings are based on assessments of Dominance and Prestige using both self- and peer-ratings. Second, Prestigious individuals have been shown to demonstrate locally valued competencies and skill. For example, in the context of collegiate varsity teams, academic achievement, and athletic, social, intellectual, and advice-giving abilities predict peers'

perceptions of Prestige (Cheng et al., 2010). In the context of a small-scale Amazonian society, hunting ability, skill in food production, generosity, number of allies, and nutritional status are associated with perceived Prestige (Reyes-Garcia et al., 2008; 2009; von Rueden, Gurven, & Kaplan, 2008). Similarly, altruism, cooperativeness, helpfulness, ethicality, and other prosocial traits—which effectively signal one’s skills and social value—were found to be associated with Prestige (Cheng et al., 2010 (Cheng et al., 2010). Third, there is evidence for distinct neuroendocrine profiles; individuals high in Prestige tend to have lower basal Testosterone levels, a hormone linked to aggressive behavior, relative to individuals low in Prestige (Johnson et al., 2007).

In addition, a large body of findings from across the social sciences supports the theoretical notion that Prestige emerged to facilitate cultural learning. For example, individuals from many small-scale, pre-industrial societies seek out opinion from the elders, who hold considerable Prestige, and grant them disproportionate influence despite their lack of formal power to enforce decisions (Dentan, 1979). Studies from developmental psychology have similarly shown that children as young as 2 years demonstrate a preference for learning from models who appear confident (and thus competent) over others who appear uncertain (Birch, Akmal, & Frampton, 2010; Jaswal & Malone, 2007; Rakoczy, Warneken, & Tomasello, 2009; Sabbagh & Baldwin, 2001). In much the same way, 3- and 4-year-old children infer Prestige from bystanders’ differential amounts of eye gaze to potential models, and use these assessments to preferentially learn from the model to whom bystanders attend most (which marks the greatest Prestige; Chudek, Heller, Birch, & Henrich, 2012). These findings have led researchers (and textbooks) in evolutionary psychology to adopt the terminology and concepts of the Dominance and Prestige Model (e.g., Buss, 2008).

In sum, the Dominance-Prestige Account provides a way of reconciling the two currently reigning, and opposing, approaches to understanding human hierarchical differentiation and the attainment of social rank. As a result, this model has two key advantages over these prior perspectives. First, although prior models that emphasize the narrow traits and attributes (e.g., aggressiveness, intelligence) predictive of high rank serve a descriptive function (i.e., providing information about the kinds of individuals who tend to attain rank, on average, across many contexts), they do not provide a causal or explanatory account. That is, such models do not address questions of *why* these behaviors effectively promote influence. The Dominance-Prestige Account, in contrast, uses evolutionary logic to generate *a priori* hypotheses about the processes underlying rank attainment in humans, such that, when these hypotheses are supported, findings explain (rather than simply describe) why a vast number of narrower attributes and characteristics give rise to influence.

Second, the Dominance-Prestige approach emphasizes broad social processes, involving *fear* and *respect*, rather than the narrower stable attributes and traits thought to underlie influence in other accounts (e.g., aggressiveness, intelligence, group commitment). Although these narrower characteristics may elicit feelings of fear or respect in others (and by implication, be part of the broader Dominance or Prestige constructs), these links are highly context-specific. For example, an intelligent college professor probably holds little influence over a recreational soccer team, compared to the team's star soccer player. In other words, stable traits and characteristics produce admiration and fear in some contexts but not others, so have limited utility in explaining cross-situational patterns of rank allocation. Thus, in the present research, we assessed individuals' relationships with group members broadly, using items such as "I respect and admire him/her," "I seek his/her advice on a variety of matters," and "I'm afraid of

him/her” (see Cheng et al., 2010). These items tap directly into the critical interpersonal perceptions central to Dominance and Prestige processes, in contrast to the narrow, static attributes typically examined in previous studies (e.g., toughness, intelligence). It should be noted that despite their being conceptualized as strategies, the pursuit of Dominance or Prestige is thought to operate outside of conscious deliberation (see Cheng et al., 2010).

1.3 Present Studies and Hypotheses

Despite the potential benefits of the Dominance-Prestige Account for explaining patterns of rank allocation in human groups and resolving prior controversies, no studies to date have empirically validated the theorized effects of Dominance and Prestige on the attainment of social rank. Thus, in this dissertation, I sought to conduct the first test of whether Dominance and Prestige are alternative avenues to attaining social rank, and additionally explore their underpinning ethologies.

If Dominance and Prestige are indeed the foundations of human social hierarchies, they should jointly explain *who* attains high social rank within groups and *how* these individuals attain rank. Furthermore, the theoretical framework predicts that two strategies rest on distinct psychological mechanisms. Dominance is predicated upon the effective inducement of fear through intimidation and threat, in both physical and psychological forms. In contrast, Prestige is predicated upon successfully obtaining the respect and admiration of others by displaying skills and know-how, and by advertising one’s accessibility as a cultural model (e.g., some degree of willingness to show a subordinate the tricks of the trade), which creates selection pressures on Prestige-seekers to act in a generous and socially appealing fashion to attract social learners. Given these divergences, the two strategies should be associated with distinct patterns of verbal

styles and nonverbal behaviors, which would allow their adopters to effectively intimidate (in the case of Dominance), or garner respect and admiration (in the case of Prestige). Stated more succinctly, the specific hypotheses that emerge from the model are as follows:

- H1. Individuals who effectively wield Dominance *or* Prestige should emerge as influential and highly ranked individuals within the social hierarchy. Because the two strategies are expected to be independent pathways, their impact on rank should operate independently of one another (i.e., they should each be positively associated with social rank even after controlling for shared variance between the two strategies).
- H2. Despite their shared function in promoting social rank, the two strategies should diverge in their associated verbal styles in characteristic ways. Specifically, Dominance should motivate the display of verbal styles that communicate threat, intimidation, and self-entitlement, whereas Prestige should motivate verbal styles that demonstrate warmth, self-deprecation (as arrogance might cue Dominance), and other socially attractive qualities.
- H3. Akin to their distinct verbal styles, Dominance and Prestige should be underpinned by distinct nonverbal postural movements that signal threat and intimidation vs. social attractiveness and competence. In particular, we predict that distinct components of the pride display, which has been shown to signal high social rank in humans (Shariff & Tracy, 2009), should differentially signal Dominance and Prestige. The Dominance behavioral signal is expected to involve the spatially expansive and more aggressive movements of the pride display, which increase perceived formidability; whereas

Prestige is expected to involve more subtle, non-threatening behaviors of the pride display, which convey confidence and competence.

H4. In the vocal domain, prior research linking lower vocal pitch to perceptions of physical prowess suggests that Dominant individuals should signal their ability to inflict bodily harm by lowering their vocal pitch. Prestige, however, is theoretically unrelated to threat potential, and therefore not expected to covary with changes in pitch.

The common thread binding together these hypotheses is that fear and admiration both give rise to rank-related asymmetries in human interpersonal relationships. Fear, on which Dominance rests, is a powerful mechanism for inducing compliance and deference. Respect, on which Prestige is predicated, is equally potent and begets freely conferred influence and persuasion. These are clearly very different psychological states of subordination, and it is therefore reasoned that very different patterns of behaviors will be favored among Dominance- and Prestige-seekers to effectively instill fear vs. respect, and gain influence over subordinates.

In the remainder of this dissertation, I present five empirical investigations of these core predictions. First, I examine whether spontaneously emerging Dominance and Prestige concurrently promote social rank within face-to-face laboratory-based groups comprised of previously unacquainted individuals. Social rank was operationalized as: group members' ratings of influence, outside observers' ratings of influence, behavioral impact over group decision-making (Chapter 2), and the amount of visual attention received from outside observers, whose gaze was monitored using an eye-tracking device (Chapter 3). Second, group members' verbal styles were coded from video-recordings of the group sessions, to test the hypothesis that Dominance is associated with characteristic verbal styles that convey intimidation and self-

entitlement, whereas Prestige is associated with verbal styles that advertise self-deprecation and social attractiveness (Chapter 4). Third, based on detailed coding of nonverbal behavior, I test whether Dominance is associated with nonverbal movements that involve a spatially expansive posture, and Prestige with movements that cue confidence and competence, and a lack of aggressive intent (Chapter 5). Finally, I examine differences in changes in vocal pitch between Dominant and Prestigious group members, predicting that Dominance should be associated with lowering of vocal pitch to signal threat, whereas Prestige should be unrelated to alterations in pitch (Chapter 6). In the final chapter of this dissertation, Chapter 7, I summarize the findings from these chapters and provide a detailed discussion of the implications and limitations of this research.

Chapter 2: Dominance, Prestige, and Social Influence

2.1 Overview

Chapter 2 sought to examine whether Dominance and Prestige spontaneously emerge and coexist as viable rank-attainment strategies within the same social groups. Specifically, we test Hypothesis 1, which proposes that individuals who effectively wield Dominance or Prestige should emerge as highly ranked individuals within the social hierarchy, by conceptualizing rank as degree of social influence.

Although no empirical efforts to date have directly examined whether Dominance and Prestige are concurrently associated with increased social rank and influence, several studies have documented positive relations between influence and narrower attributes and behaviors that are theoretically related to Dominance or Prestige. For example, Hawley (2002; 2003) found that among children aged 3 to 6, narrow coercive behaviors such as taking away a toy, insulting, or physically aggressing against another child were as likely to promote control over a desired toy as were narrow prosocial behaviors such as making suggestions and offering help. However, these studies did not directly assess Dominance or Prestige at the level of broader constructs, constituted of a range of distinct behaviors and tendencies, and thus only provide preliminary support for the suggestion that either strategy may effectively promote rank and influence. In addition, several researchers have argued that hierarchical dynamics work differently in children's social groups, in that children tolerate the use of force and coercion to obtain social rank, but adults do not (Barkow, 1975; Savin-Williams, 1980; but see Strayer & Trudel, 1984). Consistent with this view, Savin-Williams (1979) found that among children and early adolescents (age 9-13), narrow characteristics and behaviors theoretically associated with

Dominance (e.g., pubertal maturation, physical fitness, physical and verbal threats, taking or removing objects) were the strongest predictors of influence, but among middle to late adolescents (age 14-17), these same variables were unrelated to influence (Savin-Williams, 1980). Further supporting this developmental account, Hawley (2002) found that coercive 3-6 year-old children were rated as more likeable by their peers, an effect directly opposed to findings in adults, who typically dislike and reject coercive, arrogant, and aggressive individuals (Cheng et al., 2010). It thus remains to be seen whether Dominance and Prestige are viable routes to attaining influence in adult social groups. According to the Dominance-Prestige Account, Dominance hierarchies may emerge in childhood prior to the emergence of Prestige hierarchies, but this does not mean that the latter eventually replace the former.

The current study sought to test whether Dominance and Prestige each promote social rank, by assembling groups of previously unacquainted individuals in a controlled laboratory setting. Each group completed a collaborative task in the laboratory, during which rank inequalities—operationalized in the current study as differential social influence—naturally emerged. Dominance, Prestige, and perceived influence were assessed using both within-group peer-ratings and outside observers' ratings, and behavioral influence was assessed by measuring the degree to which each person shaped the group's decision-making.

Several features of the study are noteworthy. First, we measured both the distribution of actual social influence, as well as group members' perceptions of each others' influence (Buss et al., 1987). This is critical given that explicit beliefs about which tactics promote influence do not necessarily reflect the actual processes through which influence is obtained. For example, married couples rate an accommodative communication style as a useful tactic to achieve influence, but this style is, in fact, predictive of *less* decision-making power (Kipnis, Castell,

Gergen, & Mauch, 1976). Second, we assessed influence using the perceptions of both uninvolved outside observers' perceptions and involved in-lab group members. Group members may be motivated to exaggerate (or even construct) *post-hoc* perceptions of leaders' influence to rationalize the hierarchy that emerged (Anderson & Kilduff, 2009b; see Jost & Banaji, 1994).

Third, Dominance was assessed in terms of actual Dominance—based on group members' reports of a target individual's level of intimidation and threat—and not in terms of *attempted* Dominance. In prior work, narrow behaviors associated with Dominance (e.g., dismissive, intrusive, or contemptuous speech, nonverbal behaviors thought to convey Dominance) were found to be ineffective for rank attainment when a confederate's dominant behavior was resisted by observers (Ridgeway, 1987; Ridgeway & Diekema, 1989). These studies have been interpreted to suggest that coercion does not promote influence. However, these studies do not provide an adequate test of this question because they involved presumably *failed* attempts at inducing coercion; dominant confederates did not pose any real threat to participants (either because participants resisted them or because the confederate was present only via video-recording; Fiske, 1993). We therefore assessed both Dominance and Prestige on the basis of peer ratings, using previously validated scales (Cheng et al., 2010). Items on the Dominance scale focus on perceptions of threat and fear towards a target individual (e.g., "I am afraid of him/her"), whereas those on the Prestige scale focus on feelings of respect and admiration (e.g., "I respect and admire him/her"). Both scales have been previously used to assess relative Dominance and Prestige in naturalistic, long-term groups comprised of varsity athletes, and have been shown to capture substantial between-person variability along both dimensions (Cheng et al., 2010).

Fourth, the current study examined the concurrent effectiveness of spontaneously emerging Dominance and Prestige within the same social groups. Group members who possess

greater Dominance (in the eyes of other members), and, similarly, those who possess greater Prestige relative to others in the group, are expected to rise to the top of the social hierarchy. A number of researchers have argued that some studies found influence-attainment effects from coercive behaviors, whereas others found such effects from competence, because the different groups examined hold different values about legitimate bases of social rank. Thus, it is critical to directly test whether the two strategies are concurrently effective within the same social groups, to examine whether: (a) Dominance is effective in groups other than those that are simply uncooperative and value aggression over competence; (b) Dominance and Prestige are inherently incompatible or antagonistic; and (c) Dominant individuals and Prestigious individuals can attain high influence even when they directly compete against each other. No prior studies of which we are aware have met all of these criteria.

Another benefit of examining the concurrent effectiveness of the two strategies is that it provided a test of the competing accounts. For example, the competence-based account of rank allocation predicts either a null or negative association between Dominance and influence, after controlling for shared variance with Prestige. Conversely, the conflict-based account predicts that rank differences should be positively associated with Dominance but unrelated to Prestige. In contrast, the Dominance-Prestige Account holds that Dominance and Prestige represent independent and distinct avenues to social rank, and thus Dominance and Prestige should each be independently associated with high social rank, *even* after controlling for shared variance. In sum, Chapter 2 examined the social rank outcomes of individuals who exercised Dominance or Prestige in a face-to-face context.

2.2 Method

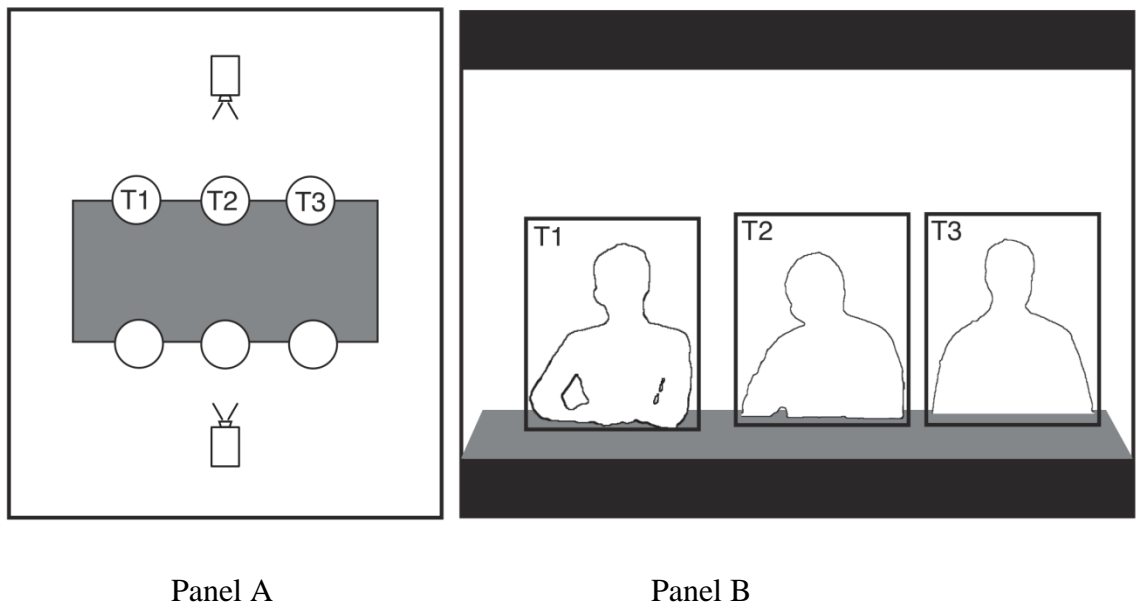
2.2.1 Participants and Procedures. 191 students at the University of British Columbia (53% male) were randomly assigned to 1 of 36 same-sex groups (18 all-male groups, 18 all-female groups), each consisting of 4 to 6 unacquainted individuals ($M = 5.31$ participants per group). Participants were contacted prior to the study to ensure that all group members were not previously acquainted. They were paid for their participation, with the chance to earn an additional monetary bonus during the study.

Upon arrival, participants were randomly assigned seats at a rectangular table, with a name tag in front of each participant identifying him/her to other group members. Participants were first asked to privately complete the “Lost on the Moon” exercise (Bottger, 1984), which involves rank-ordering 15 items (e.g., oxygen tanks, heating unit, signal flares) in order of their utility for surviving a crash landing on the moon. Next, participants worked collectively as a group for 20 minutes on the same task. They were instructed to use their previously completed private responses to guide the group discussion. To incentivize group involvement, participants were told that the group’s final decision would be scored against an answer key, and high scores would earn each group member a \$5 bonus. The 20-minute group interaction was video-recorded using two digital video cameras mounted on tripods on either side of the table (each camera captured all participants on one side of the table and no participants on the other side; either 2 or 3 participants sat on each side; see Figure 1, Panel A). Observation of the video-recorded interactions revealed that the task was engaging and evoked considerable discussion and disagreement among members.

After completing the group task, participants privately completed a post-task questionnaire in which they provided peer ratings of all group members (see below for measures),

in a round-robin design. Finally, the experimenter excused herself to purportedly score the group's submitted response on the group task.

Figure 1. Schematic layout of group interaction.



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2.2.2 Measures.

2.2.2.1 Post-task round-robin peer-ratings. Upon completing the group task, group members rated each other on a number of dimensions (listed below), on a scale ranging from 1 (“Not at all”) to 7 (“Very much”). Ratings were analyzed with the software program SOREMO (Kenny, 1998), to implement the Social Relations Model (SRM; Kenny & La Voie, 1984). SRM

partitions peer-rating scores into perceiver, target, and relationship effects. Of particular interest were *target effects*, which are, essentially, the average of all group members' ratings of a given target on a given dimension, after removing idiosyncratic perceiver and relationship biases/effects.¹ Also of interest is *target variance*, which captures the amount of variation in peer-ratings due to the target, and was used as an index of the degree of consensus among perceivers in their ratings of each target (i.e., a measure of inter-rater reliability). A larger relative target variance (i.e., target variance divided by total variance) indicates that a given target elicited a high level of consensus among group members. For example, extraversion, a highly visible trait which tends to elicit substantial observer agreement, typically elicits relative target variance levels of about 30% (i.e., 30% of the total variance is due to the target; Kenny, Albright, Malloy, & Kashy, 1994).

(a) *Perceived social influence and agency*. Participants indicated the extent to which each group member demonstrated high social influence during the task by rating each member on three items—"was paid attention", "had high status", and "led the task". All three items showed statistically significant amounts of target variance (relative target variances were 29%, 33%, and 64%, respectively, $ps < .05$,² all comparable to typically observed levels of approximately 30% relative target variance in highly visible traits such as extraversion; Kenny, Albright, Malloy, & Kashy, 1994), indicating that group members agreed on each other's relative social influence at

¹ In the present context, perceiver effect quantifies the degree to which a perceiver/rater tends to perceive a consistent level of social influence across all group members. Some perceivers tend to rate all others as influential, while others generally see others as low in influence. Relationship effect indexes the unique relationship between two persons by measuring the degree to which a perceiver rates a given target as particularly high in influence, over and above the perceiver's general tendency to see others as influential (i.e., perceiver effect), as well as the target's tendency to be seen by all other group members as influential (i.e., target effect; Kenny, Kashy, & Cook, 2006).

² Significance tests of variance components are conducted with one-tailed tests, as variances in principle cannot be negative.

better than chance levels. To further partition relationship variance from error variance, these three items were subsequently entered as multiple indicators of a latent *perceived social influence* construct (inter-item $\alpha = .89$, relative target variance = 38%).

As an additional index of perceived influence, we also assessed perceived agency—a concept involving control, power, and rank (Bakan, 1966)—which is expected to show positive associations with the two strategies. Agency was assessed using three peer-rated items culled from the Revised Interpersonal Adjective Scales: “assertive”, “self-confident”, and “timid” (reverse-scored; Wiggins, Trapnell, & Phillips, 1988). Statistically significant amounts of target variance were found across these 3 items (relative target variances were 38%, 41%, and 40%, respectively, $ps < .05$), so we aggregated across their target scores to form an overall score for agency (inter-item $\alpha = .92$, relative target variance = 38%).

(b) *Dominance and Prestige*. To capture the extent to which each participant adopted a Dominance and a Prestige strategy, peers rated the perceived Dominance and Prestige of each group member using the Dominance and Prestige Peer-Rating Scales (Cheng et al., 2010). These previously validated scales include 8 items assessing Dominance (e.g., “I am afraid of him/her; I know it is better to let him/her have his/her way”) and 8 items assessing Prestige (e.g., “I respect and admire him/her”; I do not value his/her opinion (reverse-coded); see <http://ubc-emotionlab.ca/research/#dompres> for full scales; we omitted one item—“Members of your group do not want to be like him/her”—due to its unsuitability for briefly acquainted group members). The amount of target variance in ratings across the 8 Dominance items (ranging from 10% to 36%) and across the 8 Prestige items (ranging from 10% to 35%) were statistically significant, all $ps < .05$, suggesting that group members could reliably report individual differences on both scales. Target scores for the 8 Dominance items, and the 8 Prestige items were combined,

respectively, to form an overall Dominance (inter-item $\alpha = .93$, relative target variance = 22%) and an overall Prestige (inter-item $\alpha = .89$, relative target variance = 15%) composite for each individual.

(c) *Liking*. In addition to examining the effects of Dominance and Prestige on social influence, we sought to probe the kinds of relationships that Dominant and Prestigious individuals have with followers, by examining whether the two strategies are differentially associated with peer liking. The evolutionary framework suggests that Dominance is predicated on inducing fear through coercive and intimidating behaviors, whereas Prestigious individuals have no authority or power to enforce decisions, but instead demonstrate their competence and signal their kindness, warmth, and social attractiveness to maintain respect and conferred rank. Although competence remains the centerpiece to Prestige, any behavioral indications of greater accessibility as a model—which means a lowered cost to copying from the perspective of the learner—should further elevate one’s Prestige. Further, because learners bring fitness-enhancing deference, it is reasoned that Prestigious models have the incentive to display these socially attractive behaviors to effectively compete with skilled others for a more Prestigious reputation. In brief, all else (e.g., skill) being equal, a kinder, warmer, and more socially attractive individual should be accorded greater Prestige in the eyes of group members. We therefore expected Dominance to be negatively, and Prestige positively, associated with perceived likeability. Likeability was assessed with two items: “I like this person”, and “I like working with this person”. Statistically significant amounts of target variance were found across these items (relative target variances were 15% and 22%, respectively, $ps < .05$). Consequently, their target scores were combined to form an overall score for likeability (inter-item $\alpha = .89$, relative target variance = 17%).

2.2.2.2 Behavioral measure of social influence. We quantified behavioral influence by assessing the degree to which individuals brought the collective group decision on the Lost on the Moon Task closer to their own thoughts and opinions (Cartwright, 1959; Lewin, 1951). Specifically, following Bottger's (1984) approach, we measured the degree of similarity between each participant's *private* response, completed prior to the group interaction, and the *group's* final public, collective response. For each participant, a behavioral influence score was computed by calculating the absolute difference between his/her private ranking of each Lost on the Moon item and the group's final ranking of that item, then summing across all 15 items and multiplying by -1 (for directionality scaling). This scoring procedure can be represented as:

$$y_{ij} = -1(\sum_{k=1}^{15} |x_{ijk} - x_{jk}|)$$

where y_{ij} is the influence score of subject i from group j . x_{ijk} is subject i 's rating on item k . x_{jk} is group j 's rating on item k . The expression in brackets, which captures the level of discrepancy between individual and group responses, was multiplied by -1 so that scores with a higher value (i.e., negative values closer to 0) reflect greater social influence (i.e., greater similarity between individual and group responses). The use of this behavioral measure, coupled with peers' ratings of perceived social influence, circumvented limitations associated with a sole reliance on peer-reports of social influence. This is particularly noteworthy given prior findings indicating that such perceptions may be only weakly correlated with actual task influence (Bottger, 1984; March, 1956).

2.2.2.3 Outside observer global judgments. Two research assistants, blind to the hypotheses and unacquainted with participants, independently watched all video-recorded group interactions. After viewing each session, they judged each participant on the following dimensions:

(a) *Perceived social influence, Dominance, and Prestige.* Judges rated the extent to which each group member was “influential” (inter-rater $\alpha = .87$), “bossy and pushy” (which we used as a measure of Dominance; inter-rater $\alpha = .83$), and “respected” (which we used as a measure of Prestige; inter-rater $\alpha = .70$). Ratings were completed on a scale ranging from 1 (*Not at all*) to 5 (*Extremely*).

(b) *Agency.* Judges rated each participant on the interpersonal grid (Moskowitz & Zuroff, 2005), a single-item instrument developed to measure observer perceptions of agentic interpersonal behaviors in a given target. By placing a single “X” in any square on the grid, judges rated the perceived agency of each group member (inter-rater $\alpha = .86$).

2.3 Results and Discussion

2.3.1 Do Dominance and Prestige each Predict Greater Social Influence?

To test whether Dominance and Prestige each predict social influence, we examined correlations between peer-perceived Dominance and Prestige and the three indices of influence (see Table 2 for correlations among indices). When data from men and women were analyzed separately, the effect sizes of the association between Dominance and Prestige and the measures of social influence were almost identical; there were no significant gender differences. I therefore report results based on data collapsed across genders. Both Dominance and Prestige positively predicted social influence on all three measures (see Table 3). Thus, individuals who were judged by peers to be either Dominant or Prestigious were: (a) perceived by peers as possessing high influence and agency, (b) perceived by outsider observers as possessing high influence and agency, and (c) exerted more behavioral influence over the decision-making process of the group. It is noteworthy that these correlations are based on measures of influence from three different

sources: (a) in-lab peers, (b) outside observers, and (c) a behavioral measure; given that only one of these measures overlaps in source with the measures of Dominance and Prestige, it is unlikely that shared method variance artificially inflated effects. Furthermore, as is shown in Table 3, this pattern of results was largely replicated when we used outside observers' perceptions of participants' Dominance and Prestige instead of in-lab peers' ratings of Dominance and Prestige. The only exception was that, with outside-observer judgments, the positive correlation between Dominance and the behavioral measure of influence did not reach conventional levels of significance, $p = .14$.

Table 2. Descriptive statistics and correlations among Dominance, Prestige, and social influence.

	Mean	SD	Dominance	Prestige	Perceived Influence	Perceived Agency	Behavioral Influence
Dominance	2.34	.83	.93	-	-	-	-
Prestige	4.93	.62	.01	.89	-	-	-
Perceived Influence	4.13	1.12	.68**	.57**	.89	-	-
Perceived Agency	4.63	1.12	.69**	.45**	.88**	.92	-
Behavioral Influence	-38.16	13.34	.17*	.17*	.22**	.30**	-

Note. $N = 191$. Values on the diagonal are scale alpha reliability estimates, where applicable.

* $p < .05$. ** $p < .01$.

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Table 3. Correlations of Dominance and Prestige (as rated by in-lab peers and outside observers) with social influence and likeability

Measures	In-Lab Peer-Rated		Outside Observer-Rated	
	Dominance	Prestige	Dominance	Prestige
In-Lab Peers' Ratings				
Perceived Influence	.68** (.79**)	.57** (.40**)	.59** (.62**)	.63** (.55**)
Perceived Agency	.69** (.75**)	.45** (.33**)	.59** (.59**)	.60** (.54**)
Likeability	-.06	.73**	.13†	.49**
Outside Observers' Ratings				
Perceived Influence	.57** (.54**)	.38** (.44**)	.70** (.71**)	.73** (.70**)
Perceived Agency	.56** (.52**)	.35** (.41**)	.69** (.69**)	.64** (.61**)
Likeability	-.18**	.38**	.09	.43**
Behavioral measure of influence	.17* (.17*)	.17* (.22**)	.11 (.11)	.13† (.14†)

Note. $N = 191$. Partial correlations controlling for likeability are presented in parentheses.

† $p < .10$ * $p < .05$ ** $p < .01$.

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2.3.2 Are there Group Differences in the Extent to which Dominance and Prestige Promote Social Influence?

The correlational analyses reported above cannot account for possible dependencies that may arise from groups (i.e., individuals nested within groups), violating assumptions of independently measured and uncorrelated error terms (Raudenbush & Bryk, 2002), which could bias significance tests. In addition, it is possible that the influence-promoting effects of Dominance and Prestige found here may be limited to selected groups, and not uniformly characteristic of most groups sampled. To address the possibility of systematic group differences, a two-level hierarchical linear model (HLM; Bryk & Raudenbush, 1992) was used to test whether individuals adopting either Dominance or Prestige emerged as more influential while accounting for the nesting of participants in groups.

Intra-class correlations (ICC) were first computed for each of the three influence indices to examine whether there was a significant amount of variability in each of these measures at the group level (i.e., the degree of non-independence). Results indicated that group membership did not uniformly explain the variance in influence. Minimal covariation occurred within groups on perceived social influence ($ICC = 7.9 \times 10^{-10}$) and agency ($ICC = 9.8 \times 10^{-10}$), suggesting an absence of between-group differences in mean influence scores. However, group membership produced clustering on the behavioral measure of influence ($ICC = .14$), suggesting that approximately 14% of the total variance on this measure is attributable to differences among the assigned groups. In light of this evidence suggesting some degree of clustering of social influence scores due to group membership, which may negatively bias standard errors in subsequent models employing ordinary least squares (Bliese & Hanges, 2004; Kenny & Judd,

1986), we tested the predictions with an HLM analytic framework to account for any non-independence arising due to groups.

Variance in the dependent variable (i.e., influence) was partitioned into within-person and between-person components, allowing predictor terms to be represented at the level of the person (Level 1) and the level of the group (Level 2). The coefficients for Level 1 predictor terms Dominance and Prestige were modeled as random effects, to allow the effects of Dominance and Prestige on influence to vary across groups. Three separate models were specified to estimate the concurrent effects of Dominance and Prestige on each of the three indices of influence: peer-perceived influence, peer-perceived agency, and behavioral influence. All three models shared the following formulation:

$$\text{Level 1: Influence}_{ij} = \beta_{0j} + \beta_{1j} (\text{Dominance}_{ij} - \overline{\text{Dominance}}_{.j}) + \beta_{2j} (\text{Prestige}_{ij} - \overline{\text{Prestige}}_{.j}) + r_{ij}$$

$$\text{Level 2: } \beta_{0j} = \gamma_{00} + \gamma_{01}(\overline{\text{Dominance}}_{.j}) + \gamma_{02}(\overline{\text{Prestige}}_{.j}) + \mu_{0j}$$

$$\beta_{1j} = \gamma_{10} + \mu_{1j}$$

$$\beta_{2j} = \gamma_{20} + \mu_{2j}$$

Mixed Model:

$$\begin{aligned} \text{Influence}_{ij} = & \gamma_{00} + \gamma_{01}(\overline{\text{Dominance}}_{.j}) + \gamma_{02}(\overline{\text{Prestige}}_{.j}) + \gamma_{10}(\text{Dominance}_{ij} - \overline{\text{Dominance}}_{.j}) + \\ & \gamma_{20}(\text{Prestige}_{ij} - \overline{\text{Prestige}}_{.j}) + \mu_{0j} + \mu_{1j}(\text{Dominance}_{ij} - \overline{\text{Dominance}}_{.j}) + \mu_{2j}(\text{Prestige}_{ij} - \overline{\text{Prestige}}_{.j}) + \\ & r_{ij} \end{aligned}$$

The Level 1 model expresses the influence score of person i in group j (Influence_{ij}) as a function of his or her group j 's mean influence (β_{0j}), and influence due to his or her Dominance (β_{1j}) and Prestige (β_{2j}) that is unique to group j , respectively, and a Level 1 residual term (r_{ij}). Three Level 2 equations were specified: the random intercepts (β_{0j}), the random slopes that

quantify the effect of Dominance within each group (β_{1j}), and the random slopes that quantify the effect of Prestige within each group (β_{2j}). To control for any potential effects arising from the Dominance and Prestige of fellow group members (e.g., individuals may be more influential in a group full of non-Dominant others; Dominance may be more tolerated and therefore effective in a group with Dominant others), group means on Dominance and Prestige were respectively used as predictors of the random intercept (β_{0j}), along with the group-level residual for the intercept (μ_{0j}). The two random slope equations express the Level 1 regression coefficients using a grand mean of slope across all groups and (γ_{10} and γ_{20} , respectively) and a group-specific residual (μ_{1j} and μ_{2j} , respectively). These error terms, μ_{0j} , μ_{1j} , and μ_{2j} were respectively included to permit the influence intercepts (i.e., means), the within-group Dominance and influence slope, and the within-group Prestige and influence slope to vary randomly across groups. All models were estimated in *R* using the *nlme* package (R Development Core Team, 2006; Bliese, 2012).

In this analysis, given that the primary interest involves the effects of individuals' *relative* Dominance and Prestige position *within* their group, both Level 1 predictors of Dominance and Prestige were group-mean centered (i.e., deviated around their group mean Dominance or Prestige). The within-group relationship is of interest here because it is likely that individuals' *relative position* within their group (i.e., degree to which an individual was more or less Prestigious than his/her fellow group members)—rather than their absolute score—determines rank and influence (Hox, 2010; Snijders & Bosker, 1999). By removing all between-cluster variation from the predictor, group-mean centering yields an unbiased estimate of the pooled within-group (i.e., Level 1) regression coefficients on the key predictors of interest—individual's relative Dominance and Prestige within group, γ_{10} and γ_{20} —as well as a more accurate estimate

of the slope heterogeneity (Bryk & Raudenbush, 1992; Enders & Tofighi, 2007; Hofmann & Gavin, 1998; Kreft, de Leeuw, & Aiken, 1995; Raudenbush & Bryk, 2002).

We also included aggregated group means on Dominance and Prestige as covariates to account for potential contextual or compositional effects (Firebaugh, 1978; Kreft & de Leeuw, 1998). The contextual model specified allows us to estimate the impact of group-level Dominance and Prestige on an individual's influence, over and above the effects of individual members' within-group standing on these two dimensions. For example, it is possible that individuals acquire greater rank and influence in groups in which others are particularly low in either Dominance or Prestige. Overall, the key hypothesis was tested by examining the coefficients on individual Dominance and Prestige predictors, which represent the within-group relationship between these two strategies and each measure of influence, over and above the group's mean levels of Dominance and Prestige.

The results of all three models were consistent with the key predictions in three ways (see Table 4). First, relative Dominance and Prestige each predicted greater influence across all three measures of influence: peer-perceived influence, 95% CIs [.95, 1.16] and [.89, 1.16], $ts(153) = 20.26$ and 14.76 , both $ps < .0001$, peer-perceived agency, 95% CIs [.99, 1.23] and [.72, 1.03], $ts(153) = 17.93$ and 11.08 , both $ps < .0001$, and behavioral influence within each group, 95% CIs [1.61, 6.16] and [.92, 7.33], $ts(152) = 3.37$ and 2.54 , $ps = .0009$ and $.01$, respectively. These effects control for group mean differences on Dominance and Prestige, given that within-group, group-mean deviated Dominance and Prestige were used as predictors, and that group means on Dominance and Prestige were additionally entered to account for variability in the groups' mean level influence. In addition, across all three models, likelihood ratio tests indicated that the covariance between Dominance and Prestige random slopes, τ_{12} , was non-significant:

perceived influence, $\chi^2 (1) = 1.35, p = .25$; perceived agency, $\chi^2 (1) = .54, p = .46$; and behavioral influence, $\chi^2 (1) = .005, p = .94$. These results suggest that Dominance and Prestige are independently associated with greater influence. That is, the efficacy of Dominance for promoting influence within a group is, on-average, neither related to nor dependent on the efficacy of Prestige, and vice-versa. No significant gender differences emerged.

Table 4. Hierarchical linear model summary: Effects of Dominance and Prestige on social influence

Parameters	Perceived influence	Perceived agency	Behavioral influence
<i>Regression coefficients (fixed effects)</i>			
Intercept (γ_{00})	.25 (.84)	3.82 (1.27)**	-13.22 (26.86)
Dominance (γ_{10})	1.06 (.05)***	1.11 (0.06)***	3.89 (1.15)***
Prestige (γ_{20})	1.03 (.07)***	.88 (.08)***	4.12 (1.62)*
Group-mean Dominance (γ_{01})	.25 (.11)*	.15 (0.17)	-5.18 (3.57)
Group-mean Prestige (γ_{02})	.67 (.14)***	.09 (.22)	-2.60 (4.57)
<i>Variance components (random effects)</i>			
Intercept (τ_{00})	.02	.09***	29.38**
Dominance Slope (τ_{11})	.02	.05*	.02
Prestige Slope (τ_{22})	.03	.06	4.57
Covariance (τ_{01})	-.01	.03	.03
Covariance (τ_{02})	-.01	-.01	-9.56
Covariance (τ_{12})	.02	.02	-.02.
Residual (σ^2)	.21	.19	135.62

* $p < .05$ ** $p < .01$ *** $p < .001$

Note. Parameter estimate standard errors are presented in parentheses. The predictors Dominance and Prestige are group-mean centered.

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Second, these models revealed that Dominance and Prestige together explain the majority of variance in perceived influence ($R^2 = .84$) and agency ($R^2 = .84$), and a substantially smaller but still significant portion of variance in the behavioral measure of influence ($R^2 = .12$).³ This is consistent with the Dominance-Prestige Account, which predicts that Dominance and Prestige represent the primary pathways to social rank, and thus together should explain the majority of the variation in rank differences among individuals.

Third, the estimated random variance components on each of the three models, which index the degree of between-group variation in the respective strengths of the relationship between Dominance and influence and between Prestige on influence, were not significantly different from zero except in one case [Dominance slopes predicting perceived influence, $\chi^2(1) = .79, p = .19$; agency, $\chi^2(1) = 4.87, p = .01$; and behavioral influence, $\chi^2(1) = .02, p = .45$; Prestige slopes predicting perceived influence, $\chi^2(1) = .09, p = .38$; perceived agency, $\chi^2(1) = 1.07, p = .15$; and behavioral influence, $\chi^2(1) = .05, p = .41$].⁴ These results indicated that the strength of the association between Dominance and agency showed non-trivial variation across groups. However, the remaining two measures of rank showed no between-group variations in the strength of their relation with Dominance. Thus, taken together, slope variation across groups tended not to be greater than would be expected by chance, and groups did not reliably differ in

³ The relatively smaller magnitude of this coefficient of determination on the behavioral impact measure may have resulted from the fact that in order to be influenced, participants would need to not only agree with some other, but also overturn their own previously recorded private decision, which individuals tend to resist (Mather, Shafir, & Johnson, 2000). Consequently, although this measure has the merit of assessing behavioral manifestations of influence, it is also likely to exhibit comparably less reliable variance and more noise.

⁴ Tests of random variance components were conducted using the likelihood ratio test involving two nested models, in which the -2log likelihood value of a reduced model containing a subset of the parameters estimated is compared to that in the full model. The difference in fit is subsequently tested with a Chi-square distribution. This approach is preferred to the Wald's Z statistic for accuracy, particularly in small to moderate samples (Singer & Willett, 2003). One-tailed tests were employed in testing all variance components (i.e., p -values are divided by 2) because variances, by definition, must always be greater than zero (Hox, 2010).

the extent to which relative Dominance and Prestige within groups predicted influence.

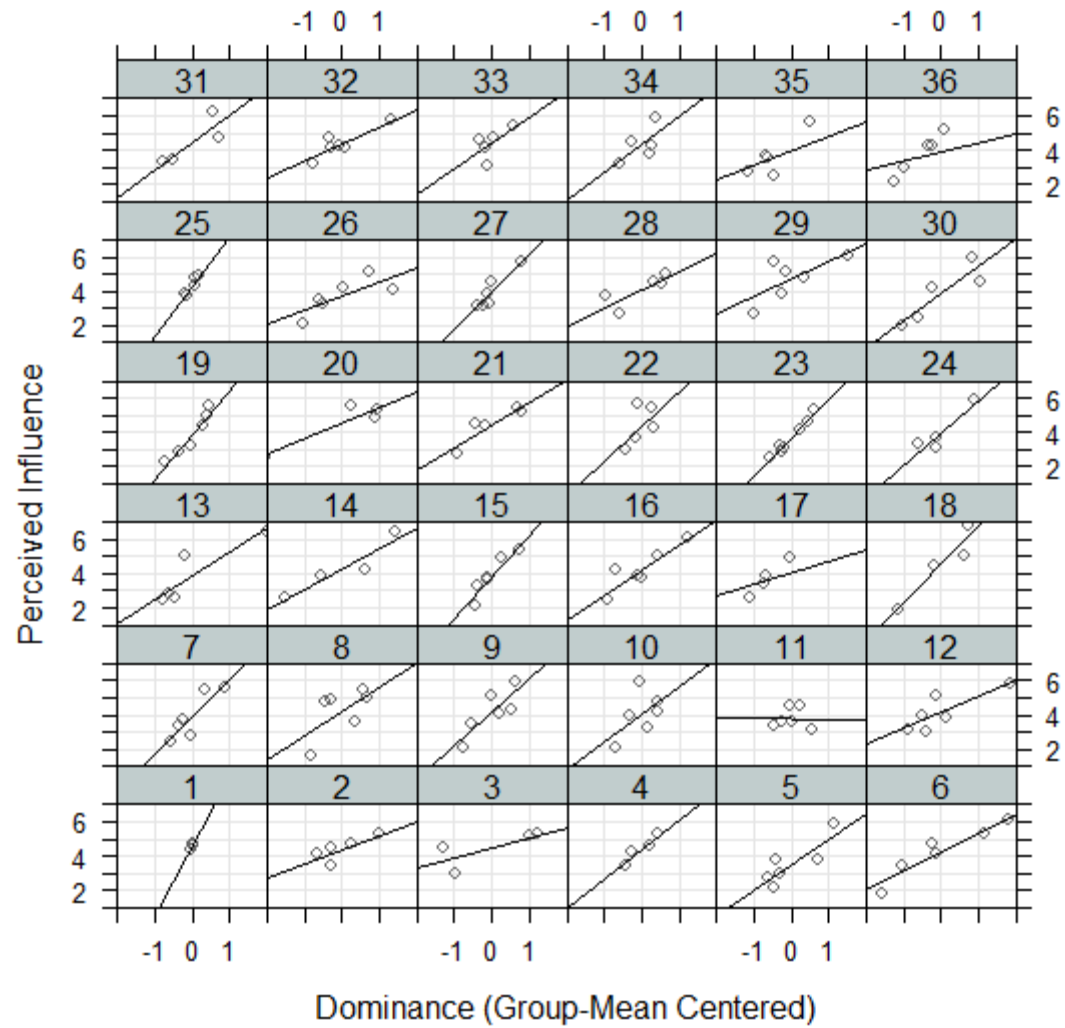
Individuals with greater Dominance and those with greater Prestige tended to uniformly acquire higher influence to a similar degree across groups.⁵

Figure 2 illustrates the relation between within-group relative Dominance and perceived influence, and within-group Prestige and perceived influence, across all 36 groups. Group number is labeled above each panel (groups #1-18 are composed of all-male participants, and groups #19-36 are all-female). Visual inspection of these figures reveals that: (a) relative Dominance and Prestige within groups were each associated with greater perceived influence fairly consistently across groups, consistent with the significant positive fixed effect estimates, γ_{10} and γ_{20} ; (b) the strength of the associations was generally uniform across groups, consistent with the random slope variance estimates, τ_{11} and τ_{22} ; and (c) in almost all groups, the slope between Dominance and influence, and between Prestige and influence, showed a positive trend.

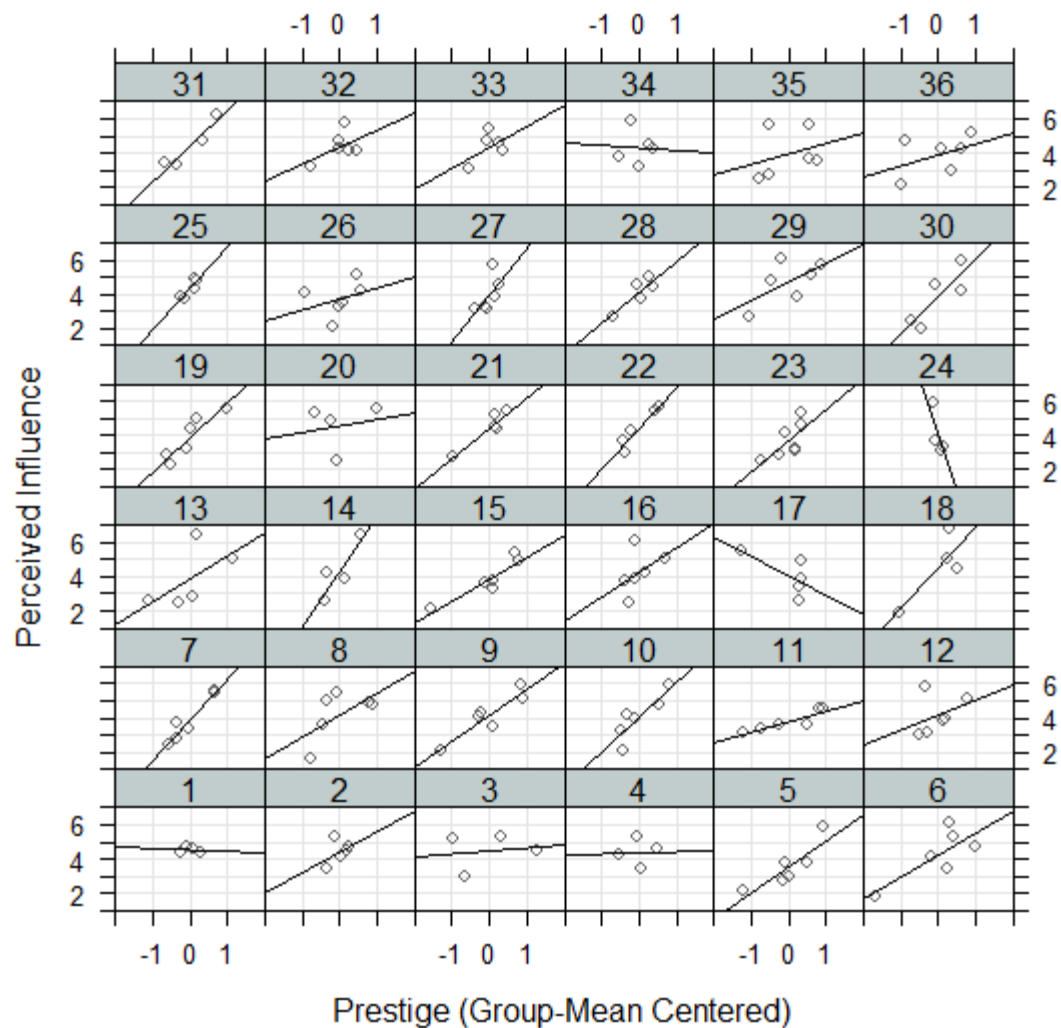
⁵ In addition, in a more restricted model, Dominance and Prestige slopes were fixed and not permitted to vary across groups (i.e., removing μ_{1j} and μ_{2j} from the main model). Not surprisingly, in this model Dominance and Prestige fixed effects (i.e., γ_{10} and γ_{20}) remained significant predictors of perceived influence, $\gamma_{10} = 1.01$, 95% CI [.94, 1.13], $t(153) = 22.01$, $p < .0001$ and $\gamma_{20} = 1.01$, 95% CI [.88, 1.14], $t(153) = 15.77$, $p < .0001$; perceived agency, $\gamma_{10} = 1.07$, 95% CI [.97, 1.17], $t(153) = 21.95$, $p < .0001$ and $\gamma_{20} = .86$, 95% CI [.72, .99], $t(153) = 12.88$, $p < .0001$; behavioral influence, $\gamma_{10} = 3.96$, 95% CI [1.68, 6.24], $t(152) = 3.43$, $p = .0008$ and $\gamma_{20} = 4.09$, 95% CI [.97, 7.21], $t(152) = 2.59$, $p = .01$. I also compared the deviance estimates between this reduced model with fixed Dominance and Prestige slopes and the main model, using likelihood ratio tests (this is akin to a multiparameter test of the joint significance of the random Dominance and Prestige slopes). Results indicated that the main model containing random slopes did not provide a significant improvement in fit over the reduced model without random slopes: perceived influence, $\chi^2(5) = 2.96$, $p = .71$, perceived agency, $\chi^2(5) = 8.18$, $p = .15$, behavioral influence, $\chi^2(5) = .83$, $p = .98$. Together, these results suggest that the magnitude of the two slopes, when considered together, did not vary significantly across groups, further supporting our conclusion of a lack of substantial group differences in the efficacy of Dominance and Prestige in promoting influence. However, although the inclusion of random slopes is important to control for any potential group differences in the efficacy of Dominance and Prestige, it is noteworthy that our hypothesis does not hinge on a complete absence of group differences. It is possible for the two strategies to be associated with higher rank in some groups than in others but still reveal a positive relation in most groups (potentially leading to non-zero random slope variances). Crucial to our hypothesis, and supported here empirically, is that the Dominance and Prestige fixed effects are not entirely driven by the random effects; that is, they should be positive and significant even after controlling for random slopes.

Figure 2. Scatter plots of social influence as a function of relative Dominance (A) and Prestige (B) in each of the 36 groups.

A



B



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2.3.3 Are Dominance and Prestige Distinct Routes to Social Rank?

Given that Dominance and Prestige were each positive predictors of all of the measures of social influence, it was important to verify that they do, in fact, represent different ways of

attaining rank. Notably, Dominance and Prestige were statistically independent ($r = .01$, $p = .85$), consistent with the notion that they represent distinct and independent concepts. Nevertheless, to further address this issue, we next examined whether individuals high in Dominance and Prestige differed on interpersonal likeability, a key dimension of social evaluation. As can be seen from Table 3, consistent with theoretical expectations, Prestigious individuals were viewed as highly likeable by both in-lab peers and outside observers, whereas Dominant individuals were viewed as dislikeable by outside observers, and neither particularly likeable nor dislikeable by peers. A comparison of these correlations (i.e., likeability with Dominance versus Prestige) revealed that in all cases likeability's association with Dominance differed significantly from that of Prestige (Z s = -9.11, -5.05, -6.02, and -4.62, respectively, all p s < .001). Thus, Dominance and Prestige appear to be divergent interpersonal strategies to attaining social rank.⁶

2.3.4 Does Liking Promote Social Rank?

To address the question of whether interpersonal liking alone is sufficient for acquiring social influence, we correlated measures of liking with measures of social influence. In-lab peers' perceptions of participants' likeability were positively correlated with their perceptions of participants' social influence ($r = .45$) and agency ($r = .32$), and with outside observers'

⁶ To examine whether Dominance and Prestige interact to predict influence (e.g., is the highest social rank found among individuals who adopt both strategies simultaneously?), we fitted three HLM models associated with the outcome variables of perceived influence, perceived agency, and the behavioral measure of influence. Similar to the HLM models presented above, group-mean centered Dominance and Prestige were entered as Level 1 predictors, group's mean Dominance and Prestige were entered as Level 2 predictors of the group intercept, and the intercept, Dominance slope, and Prestige slopes were modeled as random effects. In these models, we additionally entered the interaction of (group-mean centered) Dominance and Prestige, $\beta_{3j} [(Dominance_{ij} - \overline{Dominance}_{.j}) \times (Prestige_{ij} - \overline{Prestige}_{.j})]$, as a Level 1 predictor, and its effect was allowed to vary randomly across groups. We found no evidence for any substantive interactive effects; the interaction term in all three models did not differ significantly from zero at conventional levels of significance [perceived social influence, $\gamma_{30} = .13$, 95% CI[-.06, .33], $t(152) = 1.39$, $p = .17$; perceived agency, $\gamma_{30} = -.18$, 95% CI[-.40, .05], $t(152) = -1.54$, $p = .13$; behavioral influence, $\gamma_{30} = -1.53$, 95% CI[2.99, -6.05], $t(151) = -.66$, $p = .51$], and all of these non-significant interaction effects were clearly much weaker than the significant main effects.

perceptions of influence ($r = .29$) and agency ($r = .25$; all $ps < .01$). However, likeability was unrelated to behavioral influence ($r = .02$, $p = .76$). Furthermore, outside observers' ratings of participants' likeability were not significantly related to outside observers' perceptions of influence or agency, or in-lab peers' ratings of influence or agency, or the behavioral measure of influence (rs ranged from $-.04$ to $.10$, ps ranged from $.17$ to $.75$). This discrepancy between in-lab peers' and outside observers' likeability judgments may reflect the fact that in-lab peers' perceptions of participants' likeability were, to some extent, *post-hoc* constructions formed to rationalize the hierarchy that emerged (Lee & Ofshe, 1981; Sherman, 1983). This is based on the assumption that outside observers would not be motivated to view high ranking group members as likeable, whereas group members themselves must, in a sense, "live with" the hierarchy that emerged, as well as the finding that behavioral influence was unrelated to likeability ratings from either set of perceivers. These findings also lend some support to theories that conceptualize influence as orthogonal to liking (Coie et al., 1982; Foa & Foa, 1974; Wiggins & Trapnell, 1996).

Nonetheless, to more conclusively rule out the possibility that the associations of Dominance and Prestige with social influence were driven by liking, we next computed partial correlations between peer-rated Dominance and Prestige and the three measures of influence, controlling for peers' liking. As is shown in Table 3 (in parentheses), all effects held controlling for liking, suggesting that likeability is neither necessary for the attainment of rank, nor sufficient, according to outside-observers' perceptions of influence and the behavioral measure of influence.

2.4 Summary

In sum, these results provide converging support for Hypothesis 1, which predicts that Dominance and Prestige should each be effective routes to social rank. This finding emerged

from three different kinds of data—(a) ratings of Dominance, Prestige, and social influence from in-group peers, (b) ratings of Dominance, Prestige, and social influence from outside-observer judges, and (c) a behavioral measure of influence. Importantly, the association between each strategy and influence did not differ significantly between groups, consistent with the notion that, on average, Dominance and Prestige concurrently promote social rank uniformly across groups. Thus, by and large, the strengths of the associations across groups were not greater than would be expected by chance, and groups did not differ significantly in the extent to which relative Dominance and Prestige within groups predicted influence. Individuals with greater Dominance and those with greater Prestige tended to uniformly acquire higher influence to a similar degree across groups. These relations held while controlling for how much participants were liked, suggesting that the effectiveness of Dominance and Prestige in obtaining social rank cannot be attributed to effects of these strategies on targets' likeability; and, in fact, Dominance and Prestige seemed to have completely opposite effects on likeability.

Chapter 3: Dominance, Prestige, and Social Attention

3.1 Overview

Chapter 2 revealed that individuals who adopted Dominance or Prestige strategies became high-ranking members in the group—they were rated by group members and outside observers as more influential, and demonstrated greater decision-making impact over the group task, lending consistent support to Hypothesis 1. Chapter 3 further tested this hypothesis by using the amount of visual attention received from others as a measure of social rank. Specifically, we examined whether the allocation of visual attention—a social outcome described as “the best framework for analyzing social rank as it takes into account all leadership styles” (Hold, 1976, p. 179; also see Chance, 1967; Fiske, 1993)—is associated with either Dominance or Prestige. Specifically, observers who were unacquainted with participants from Chapter 2 wore an eye-tracking device while viewing video clips of the Chapter 2 group interactions, and we assessed the extent to which their gaze was attracted by Dominant and Prestigious targets.

A number of developmental studies provide preliminary evidence for a link between heightened visual attention and Dominance and Prestige. For example, children who are more frequently imitated, obeyed, and preferred as interaction partners (i.e., Prestigious), as well as children who frequently prevail in physical contests (i.e., Dominant), tend to receive the most looks or glances from their peers (Abramovitch, 1976; Hold, 1976; La Freniere & Charlesworth, 1983; Vaughn & Waters, 1981). Similarly, teacher-rated aggressiveness, observed dominant acts, peer liking, and the degree to which a child is imitated have all been found to predict the number of glances received from other children (Abramovitch & Grusec, 1978; La Freniere &

Charlesworth 1983; but see Vaughn & Waters, 1981). In this literature, others' glances or visual attention is typically operationalized as an indicator of social rank.

However, despite a theoretical emphasis on visual attention as an indicator of social rank, we are aware of only two prior studies that examined whether rank is associated with the reception of greater visual attention in adult populations. In one study, observers wearing an eye-tracking device were found to selectively attend to photos of individuals displaying cues of Prestige (i.e., males in professional attire); Dominance was not examined (Maner, DeWall, & Gailliot, 2008). In the other study, individuals who were rated by other group members as "leading the task" were found to receive the most visual attention from unacquainted observers who wore an eye-tracking device while viewing video-recordings of the group interactions (Foulsham, Cheng, Tracy, Henrich, & Kingstone, 2010). Neither of these studies separately examined Dominance and Prestige, so it remains unclear whether each strategy results in greater visual attention. Theoretically, Dominants may be visually tracked out of fear of unexpected attacks (though direct eye contact may be avoided in cases where Dominants can notice others' stares, which could signal a challenge; Exline, Ellyson, and Long, 1975; Mazur & Booth, 1998), and Prestigious individuals may be carefully monitored to facilitate learning and copying.

The goal of Chapter 3 was to determine whether gaze allocation patterns corresponded to perceived Dominance and Prestige. By using the video-recorded interactions from Chapter 2 as stimuli in Chapter 3, we measured visual attention received by individuals in each group, and examined how eye-tracked participants' attention varies as a function of targets' Dominance and Prestige.

3.2 Method

3.2.1 Participants and Procedures. Fifty-nine undergraduates at the University of British Columbia (61% female) participated in exchange for course credit. All participants were unfamiliar with the target individuals in the video stimuli.

Participants were instructed to watch a series of six 20-second video clips portraying three people working together on the group task described in Chapter 2 (see Figure 1 for a schematic). Participants were told to “Imagine that you’re in the room with these people, working on the task. Please think about which of the people in the group you would want to work with in a subsequent task”. These instructions were given to prompt participants to view the video clips in a similar frame of mind as the individuals featured in the clips. While wearing an eye-tracker, participants then viewed the six clips (of the same group of 3 targets) in a randomly determined order (i.e., non-chronological), to prevent them from discerning Dominance and Prestige on the basis of the sequential content of the interactions, and instead encourage them to focus them on targets’ verbal and nonverbal behaviors within each clip. The video clips were shown on a 19-inch computer monitor with a refresh rate of 60 Hz. Participants used a headrest, which minimized head movements and ensured a constant viewing distance of 60 cm, which resulted in a screen size of 40° by 31° of visual angle. Sound was played through a pair of speakers positioned on either side of the monitor. The Eyelink II system was used to record participants’ eye movements with a head-mounted camera. Pupil position was recorded monocularly from the video image of the right eye at 500 Hz.

At the beginning of each of the six clips, a drift-correct marker was presented in the center of the screen, and participants were required to look at the dot and press a key on the keyboard when central fixation was attained. The clip then appeared, and video and audio were

played at normal speed for the 20-sec duration. Eye movements were recorded during this time, along with a record of timestamps indicating the onset time of each frame of the video. After viewing all 6 clips, participants rated the perceived Dominance, Prestige, and perceived social influence of each of the targets in the clips using the same scales as were completed by in-lab peers in Chapter 2.

Upon completion of all data collection, a research assistant viewed all 24 clips at reduced speed and logged the beginning and end of each utterance or verbalization made by each target. This was repeated three times per clip (once for each target), to accurately assess the total number of seconds each target spoke. Speaking duration times were subsequently divided by the length of each associated clip (i.e., 20-sec), to determine the proportion of time within each clip each target was speaking, then aggregated across the 6 clips to determine each target's overall mean proportion of volubility (i.e., speaking time). Volubility was subsequently entered into analyses as a covariate, given the expectation that it would significantly affect Dominance, Prestige, and visual attention.

3.2.2 Stimuli. Four sets of video clips portraying a trio of Chapter 2 participants completing the group decision-making task were selected from all available clips on the basis of relative Dominance and Prestige ratings (made by in-lab peers in Chapter 2) of the targets. Given that the goal of the present study was to test whether individuals who are relatively more Dominant and those who are relatively more Prestigious are likely to receive greater visual attention from onlookers compared to individuals who score relatively lower on either dimension, it was important to ensure that each video clip featured individuals who differed substantially from each other in perceived Dominance and Prestige. Indeed, across the four sets of videos, there was a significant difference in in-lab peer perceived Dominance (based on Chapter 2)

between targets with the highest score ($M = 4.77$) and those with the lowest score [$M = 2.04$; $d = 4.59$, $t(6) = 6.49$, $p = .00064$]; and a significant difference in in-lab peer-perceived Prestige between targets with the highest score ($M = 5.76$) and those with the lowest score [$M = 4.45$; $d = 2.40$, $t(6) = 3.40$, $p = .02$].

Participants viewed 6 clips, each 20-sec in length, from each of the 4 video sets. These were selected by a research assistant blind to research hypotheses who was instructed to select segments during which a key decision was made by the group. Each participant viewed clips of only one set of targets (i.e., 6 clips from the interaction).

3.3 Results and Discussion

3.3.1 Data Analytic Approach. To determine the amount of visual attention participants paid to each target, a region of interest (ROI) was defined around each target, at a consistent size of 10.9° by 14.1° (see Figure 1, Panel B). Fixations landing within a target's prescribed ROI (depicted with a box around the target in Figure 1) were classified as attention allocated to that target. Two indices of attention—mean proportion of fixations out of the total number of fixations made, and total fixation duration—were computed for each participant. Mean proportion of fixations was computed for each participant by dividing the total number of fixations that fell within a given target's ROI by the total number of fixations that occurred during the 20-sec clip, averaged across all 6 clips. Total fixation duration was computed by taking, for each participant, the sum duration of all the fixations (in sec) on a given target's ROI, across all 6 clips. This index reflects differences in the total length of time participants gazed at each target, over and above the number of fixations, and is thus qualitatively distinct from the proportion of fixations index.

For each index of attention, the study design yielded three observations for each participant—one for each of the three targets in each clip. These three attention scores were grouped and nested within each participant, potentially leading to a lack of independence for individual observations within subjects, and thus violating assumptions of independence and homoscedasticity in ordinary least squares-based approaches (Bliese & Hanges, 2004; Kenny & Judd, 1986). Indeed, intra-class correlations (ICC) indicate a high degree of covariation among observations within each participant cluster for the mean proportion of fixations index (ICC = -.32) and the total fixation duration index (ICC = -.30).⁷ Thus, to account for the non-independence between observations produced by such nesting, clustered robust standard errors were used to derive accurate estimates of standard errors (Wooldridge, 2003).

3.3.2 Do Dominant individuals and Prestigious Individuals each receive Greater Visual Attention? We conducted two multiple regression analyses predicting each index of attention (proportion of fixations and total fixation duration) on eye-tracked participants' ratings of each target's perceived Dominance and Prestige and two control variables: target volubility and seating position (i.e., whether the target was assigned to sit in the left, right, or center position at the table). To facilitate interpretation, all predictors were grand mean centered, with the exception of seating position, which was dummy coded (as 0 for side, or 1 for center; the assumption was that the center-seated target might receive greater attention than the other two due to his/her position). In all models, clustered robust standard errors were used, clustering on

⁷ Negative empirical estimates (and population values) of the ICC can arise when the average covariance among the items is negative (Shrout & Fleiss, 1979), reflecting the bounded nature of the data here; that is, greater visual attention to one target would necessarily lead to less attention to other targets (see Kenny et al., 2006, p. 33 for a similar example).

participants because the analyses compiled repeated observations from the same eye-tracked participants, who each provided multiple observations.

Table 5 presents the two regression models. Controlling for eye-tracked participants' judgments of target's Prestige, volubility, and seating position, the regression coefficients for Dominance were statistically significant and positive in both models, indicating that a 1-point increase in perceived Dominance was associated with a 2% increase in proportion of fixations and 2.11 additional seconds of total fixation duration in a 20-second video stimuli. Similarly, controlling for targets' perceived Dominance, volubility, and seating position, the regression coefficients for Prestige were significant and positive in both models, indicating that a 1-point increase in perceived Prestige was associated with a 2% increase in proportion of fixations and an additional 1.94 seconds of total fixation duration.

In both models, volubility and seating position also emerged as significant predictors, suggesting that these factors also influenced attention, as expected based on previous research (Aries, Gold, & Weigel, 1983; Cashdan, 1998; Cohen, 1994; Mast, 2002; Mullen, Salas, & Driskell, 1989). Volubility was also positively associated with eye-tracked judges' perceptions of Dominance ($r = .68$) and Prestige ($r = .35$). There were no perceiver gender or target gender main or interactive effects. As an additional check of whether seating position, which was controlled for in the aforementioned model in the form of a single bivariate dummy code, affected the present results, we ran analyses with two dummy codes representing the three seating positions (left, center, or right). In all models, there was no significant effect of left vs. right seating position. Furthermore, all reported results hold when three dummy variables were entered as covariates in the models to account for any potential differences due to the four different clip sets used.

It is noteworthy that controlling for volubility is a conservative approach to testing the effects of Dominance and Prestige on attention. Theoretically, Prestigious individuals should be deferred to and invited to speak (by subordinates who wish to acquire their skills and knowledge), whereas Dominant individuals should forcefully occupy discussions. Thus, increased volubility is a theoretically predicted effect endogenous to Dominance and Prestige processes, and not necessarily a confound. Nonetheless, by controlling for volubility we were able to ensure that differences found were not entirely attributable to how much each target spoke.

Table 5. Regression model summary: Effects of Dominance, Prestige, and control variables on visual attention.

Predictor Variable	Measure of Attention					
	Proportion of Fixations			Total Fixation Duration (s)		
	<i>b</i> (SE)	β	<i>t</i>	<i>b</i> (SE)	β	<i>t</i>
Dominance	.02 (.01)	.18	2.47*	1.60 (.76)	.17	2.11*
Prestige	.02 (.01)	.16	3.09**	1.94 (.73)	.15	2.65*
Volubility	.43 (.05)	.48	8.97**	53.69 (6.63)	.49	8.09**
Position†	.06 (.02)	.47	3.60*	6.11 (1.84)	.44	3.32**
<i>R</i> ²		.66			.64	

Note. *N* = 177. Clustered robust standard errors were used to adjust for non-independence of observations resulting from repeated observations from the same participants, 59 individuals (clusters).

* $p < .05$. ** $p < .01$. †Position is an individual-level dummy variable with “0” representing seating on the left or right side, and “1” representing center position.

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If Dominance and Prestige represent fundamental pathways to social rank, the two strategies together should explain substantial portions of variance in attention. To test this prediction, we next ran separate regression models with proportion of fixations and total fixation duration as outcomes, and eye-tracked judges’ ratings of Dominance and Prestige as predictor variables [here, the two predictor variables showed a small positive association (using clustered

robust standard errors), $\beta = .20$, $t(58) = 2.86$, $p = .0059$], after standardizing all variables. Again, clustered robust standard errors were used. As expected, Dominance and Prestige were each significantly associated with both measures of attention—proportion of fixations, $\beta_s = .56$ and $.24$, $t(58)s = 7.79$ and 3.72 , $ps < .001$, and total fixation duration, $\beta_s = .55$ and $.23$, $t(58)s = 7.03$ and 3.36 , $ps < .01$. Furthermore, perceived Dominance and Prestige explained considerable amounts of variance in proportion of fixations, $R^2 = .48$, 95% CI [.31, .65] and total fixation duration, $R^2 = .46$, 95% CI [.28, .64]. Together, these results suggest that Dominance and Prestige were each strongly associated with the reception of greater visual attention, and these effects were independent of how much targets spoke and where they sat.

To ensure that eye-tracked judges' perceptions of targets' Dominance and Prestige were accurate, we next examined correlations between these judges' ratings of targets and those made by Chapter 2 in-lab peers, on these dimensions. Results indicated that the two sets of viewers showed substantial agreement in their ratings of targets' Dominance and Prestige ($r_s = .79$ for Dominance and $.66$ for Prestige, $ps < .05$; note that these correlations were conducted across the 12 targets, not across participants). These correlations are particularly noteworthy given that the two sets of participants had access to substantially different amounts of information and made their ratings after engaging in very different tasks. That is, judgments of Dominance and Prestige made by in-lab peers who engaged in face-to-face interactions with targets for 20-minutes, with the goal of completing a collaborative task, converged with judgments made by outside observers who merely viewed targets on video for a total of 120-sec truncated into fragmented and randomized 20-sec segments, while “imagining” that they were interacting with them. This high level of convergence suggests that both sets of perceptions were valid measures of targets' use of Dominance and Prestige strategies. Furthermore, these correlations also suggest that even

under conditions of limited exposure, observers can make highly accurate judgments of Dominance and Prestige.⁸

3.3.3 Does Liking Promote Social Attention? To examine whether the effects of Dominance and Prestige on visual attention might be due to targets' likeability, we next separately regressed each of the two attention indices on eye-tracked participants' ratings of targets' likeability, Dominance, and Prestige, as well as volubility and seating position. As in the previous models, all variables were standardized and clustered robust standard errors were used to account for the non-independence of observations in the outcome variables. In both models, all predictor variables—except for perceived likeability [$\beta = -.03$, $t(58) = -.37$, $p = .71$, for proportion of fixations; and $\beta = -.00$, $t(58) = -.01$, $p = .99$, for total fixation duration]—significantly predicted the distribution of attention. Thus, after controlling for likeability, volubility, and seating position, perceived Dominance was still associated with an increase in proportion of fixations [$\beta = .17$, $t(58) = 2.18$, $p = .03$] and total fixation time [$\beta = .17$, $t(58) = 2.06$, $p = .04$], as was perceived Prestige, with proportion of fixations [$\beta = .18$, $t(58) = 2.26$, $p = .03$], and total fixation time [$\beta = .15$, $t(58) = 1.96$, $p = .05$]. Thus, the increased social attention received by highly Dominant targets and highly Prestigious targets cannot be attributed to how much these targets were liked or disliked and, in fact, the extent to which targets were viewed as likeable did not affect the amount of attention they received.

⁸ Of note, we could not directly test whether eye-tracked participants' attention covaried with targets' Dominance and Prestige as judged by in-lab peers from Chapter 2 because there were too few observations on the dependent variable; only 12 Dominance or Prestige in-lab peer-rated scores were available. Though we considered converting the Chapter 2 continuous peer-ratings into relative Dominance and Prestige categorical ranks and using ANCOVA to address this issue, we realized this was not possible because of the naturalistic design of the study. Targets were not seated according to their Dominance or Prestige ranks (since these emerged only afterward), so the three factors of Dominance, Prestige, and seating position (the last of which must be included as a covariate, given the natural tendency for center-seated targets to receive the greatest visual attention) were not fully crossed at each level. In fact, no targets (and thus observations) were available in the following cross-tabulated cells: low-Dominance, center-seating position; and medium-Prestige, center-seating position.

3.4 Summary

Chapters 2 and 3 examined the links between Dominance, Prestige, and social rank, and found consistent support for Hypothesis 1 presented in Chapter 1: Dominance and Prestige represent distinct yet viable avenues to social rank. Using a multi-method approach—in which social rank was operationalized both as in-lab peers’ and outside observers’ perceptions of social influence, as well as actual, behavioral influence over decision-making in a collaborative task—Chapter 2 demonstrated that individuals high in Dominance and those high in Prestige (as rated by in-lab peers and outside observers) tend to receive greater influence during a group task. Chapter 3 replicated this finding with rank operationalized as social attention; highly Dominant group members and highly Prestigious group members tend to receive greater visual attention from outside observers than their counterparts who are low on both dimensions. Support for the hypothesis was thus replicated across two measures of visual attention and two sources of Dominance and Prestige perceptions, and held controlling for volubility and seating position. Together, these findings provide evidence for the central claim of the Dominance-Prestige Account—Dominance and Prestige are each effective strategies for attaining social rank in contemporary human groups, even when Dominant and Prestigious individuals directly compete for rank within the same group.

Chapter 4: Verbal Styles of Dominance and Prestige

4.1 Overview

Chapters 2 and 3 provide strong support for Hypothesis 1, which proposed that Dominance and Prestige are effective strategies for ascending social hierarchies. The remaining chapters move beyond this question to test Hypotheses 2, 3, and 4, which concern the ethological differences that underpin each strategy. Chapter 4 began this line of inquiry by exploring whether the verbal styles shown by Dominant individuals differ from those shown by Prestigious individuals in characteristic ways. Using fine-grained coding of verbal styles spontaneously displayed by individuals during the social interactions examined in Chapters 2 and 3, we tested whether Dominance is associated with the display of verbal styles that communicate threat, intimidation, and self-entitlement, and whether Prestige is, in contrast, associated with verbal styles that demonstrate warmth, self-deprecation, and social attractiveness.

The Dominance-Prestige Account predicts that Prestigious individuals should demonstrate warmth, social attractiveness, and pro-sociality for at least two reasons (see Henrich & Gil-White, 2001). First, these communal behaviors augment perceptions of Prestige. Unlike Dominant individuals, who gain influence by intimidation and fear, the Prestigious have no authority or coercive force to enforce decisions, and must instead maintain respect and attract more followers (which brings deference and other fitness-enhancing perks) by appearing as accessible and low-cost cultural models. Although skill and competence remain at the core of one's perceived desirability as a model, these attributes are aggregated with the costliness of access in determining a model's overall Prestige. Given that it is often more difficult to inflate one's apparent level of skill and expertise, selection pressures should favor models who lower

their cost of access in their effort to out-excel other Prestigious models with whom they are competing for deferential learners.

Second, the tendency among social learners to imitate skilled individuals creates extra incentives for the Prestigious to act pro-socially. This imitative tendency alters the prestigious' incentives because, if a prestigious individual cooperates (e.g., contributes to the group) others are likely to follow suit, increasing the Prestigious individual's immediate payoff. If a prestigious individual defects, others are likely to defect, reducing any potential free-riding benefits for the Prestigious individual. Dominants' behaviors are not copied, so any attempts at pro-sociality (cooperation or altruistic punishment) on their part will not result in increased pro-sociality in the group as a whole (Henrich, 2005). In contrast, for dominants, pro-sociality would mitigate the evoked fear among subordinates that confers their coercive influence.

Consistent with these lines of reasoning, findings from my master thesis research showed that Dominant and Prestigious individuals tend to have divergent personality and emotional profiles (Cheng et al., 2010). In particular, Dominance is associated with self-aggrandizing, aggressive, and disagreeable dispositions, and with the arrogance- and egotism-based "hubristic" form of pride. In contrast, Prestige is associated with altruistic and generous dispositions and the more pro-social, self-confident "authentic" pride. Furthermore, Prestige was associated with greater altruism, cooperativeness, helpfulness, ethicality, and morality. Dominance was, in contrast, negatively associated with all of these dimensions. Building on these findings, we predicted that Dominants' verbal styles should signal intimidation, condescension, and self-absorption, whereas Prestigious individuals' verbal styles should communicate a sense of self-deprecation and warmth, so as to draw respect and admiration.

4.2 Method

The video-recordings of group interactions described in Chapter 2 served as the critical stimuli for the present study. The same two trained research assistants from Chapter 2—who provided outside-observer judgments of influence, Dominance, and Prestige of each group member after watching each of the video-recorded group interactions—coded each participant’s verbal style. Specifically, they rated the extent to which participants demonstrated each of 7 specific indicators of intimidation and self-entitlement: “appearing domineering and overbearing”, “teasing others in a dominant way”,⁹ “appearing manipulative and exploitative”, “teasing others in a humiliating way”, “forcefully pushing one’s ideas or opinion”, “attributing success to one’s own contributions and efforts”, and “gesturing to self and one’s importance”. They also rated the extent to which participants demonstrated each of 6 indicators of social attractiveness: “seeking the group’s approval on matters”, “inviting others to challenge one’s ideas or views”, “appearing self-deprecating”, “teasing others in a flattering way”, “attributing success to team efforts”, and “telling jokes or using humor” (see Table 6 for inter-rater reliabilities). These items were derived from Henrich and Gil-White’s (2001) ethological predictions and a *post-hoc* examination of the video clips for verbal styles theoretically relevant to Dominance and Prestige. Each behavior was rated on a scale ranging from 1 (*Not at all*) to 5 (*Very much*). It should be noted, however, that because coders were presented with the full, unmodified video-recordings of group interactions, judgments of verbal styles were likely influenced by both the content of participants’ verbalizations and accompanying nonverbal

⁹ Items assessing different forms of teasing were adapted from Keltner, Young, Heerey, Oemig, and Monarch (1998).

behaviors (e.g., postural displays, vocal pitch and tone, etc.). Consequently, our measures of verbal style likely reflect both verbal content and style of speech.

4.3 Results and Discussion

To address our hypothesis concerning the distinct verbal styles that underlie Dominance and Prestige (i.e., Hypothesis 2), we first factor analyzed outside observers' behavioral judgments, to determine whether the items we developed to assess intimidation and entitlement, and social attractiveness, loaded onto two dimensions along these lines. Specifically, we conducted an adjusted principal components analysis, with Varimax rotation, on all 13 items.¹⁰ As predicted, the scree test indicated two components: eigenvalues for the initial six components were 4.69, 2.23, 1.43, .99, .75, and .60. Together, these first two components accounted for 44.76% of the variance (29.95% for the first component, and 14.82% for the second component). As shown in Table 5, the 7 items presumed to capture intimidating and self-entitling behaviors loaded highly and positively onto the first component, and had low cross loadings; whereas the other 6 items, presumed to capture socially attractive behaviors, loaded highly and positively onto the second component, and had low cross loadings. We thus labeled the first component 'Intimidation and Entitlement' and the second component "Social Attractiveness".

¹⁰ An Oblimin rotation revealed that the two components were essentially uncorrelated ($r = .13, ns$).

Table 6. Verbal styles factor loadings and correlations with Dominance and Prestige.

Factor / Item	Factor Loadings			Correlations		
	Inter-Rater Reliability Alphas	Component 1	Component 2	Dominance	Prestige	Perceived Influence
Intimidation and Entitlement						
Appearing domineering and overbearing	.63	.84		.56**	-.02	.45**
Teasing others in a dominant way	.70	.82		.59**	.01	.47**
Appearing manipulative and exploitative	.50	.76		.46**	.00	.41**
Teasing others in a humiliating way	.64	.69		.51**	.11	.43**
Forcefully pushing one's ideas or opinion	.75	.67	.23	.46**	.25**	.52**
Attributing success to one's own contributions and efforts	.68	.64		.36**	.13	.43**
Gesturing to self and one's importance	.57	.63	.30	.41**	.14	.44**
Social Attractiveness						
Seeking the group's approval on matters	.50	.26	.65	.19**	.32**	.40**
Inviting others to challenge one's ideas or views	.64	.27	.61	.09	.26**	.38**
Appearing self-deprecating	.59	-.19	.56	.01	.15*	.07
Teasing others in a flattering way	.63		.56	.11	.21**	.26**
Attributing success to team efforts	.68		.47	.01	.15*	.12
Telling jokes or using humor	.61		.35	.12	.27**	.30**

Note. $N = 191$. Factor loadings were generated from an adjusted principal components analysis (with Varimax rotation) of the 13 items. Loadings below .20 are not presented.

* $p < .05$ ** $p < .01$.

We aggregated, respectively, the 7 Intimidation and Entitlement items, and the 6 Social Attractiveness items, to form two composite measures (inter-item α s = .76 and .60, respectively). These two scales correlated .32 ($p < .001$), likely arising from the shared variance in agency. Thus, to examine the unique association of each with Dominance and Prestige strategies, we conducted multiple regression analyses separately predicting Dominance and Prestige from both scales entered simultaneously as predictors, after standardizing all variables. As was predicted, Dominance was positively and strongly associated with Intimidation and Entitlement (controlling for Social Attractiveness), $\beta = .61$, $t(187) = 9.81$, $p < .001$, 95% CI [.48, .73], but not significantly related to Social Attractiveness (controlling for Intimidation and Entitlement), $\beta = -.02$, $t(187) = -.33$, ns , 95% CI [-.14, .10]. In contrast, Prestige was positively associated with Social Attractiveness (controlling for Intimidation and Entitlement), $\beta = .37$, $t(187) = 5.29$, $p < .001$, 95% CI [.24, .51], but not significantly related to Intimidation and Entitlement (controlling for Social Attractiveness), $\beta = .06$, $t(187) = .84$, ns , 95% CI [-.08, .20].¹¹

If the two global behavioral patterns identified here underpin the distinct pathways to rank, then the enactment of these behaviors, by evoking perceptions of Dominance or Prestige, should in turn lead to higher social rank. We tested this possibility by next examining the

¹¹ To examine potential gender differences, I ran two separate regressions predicting Dominance and Prestige from Intimidation and Entitlement, Social Attractiveness, Intimidation and Entitlement \times gender, and Social Attractiveness \times gender interaction terms. None of the gender main or interactive effects reached significance at conventional levels. Specifically, in the Dominance model, coefficients on gender [$b = -.15$, $t(185) = -1.20$, $p = .23$] and Intimidation and Entitlement \times gender [$b = .20$, $t(185) = 1.53$, $p = .13$] did not differ from zero, and the Social Attractiveness \times gender term [$b = -.26$, $t(185) = -1.93$, $p = .06$] was marginally significant. To explore this marginal effect, I examined the simple slopes for men and women separately. For men, the association between Social Attractiveness and Dominance trended in the positive direction but the strength of the association did not reach significance, $b = .12$, $t = 1.38$, $p = .17$. For women, the association trended in the negative direction but again did not reach significance, $b = -.14$, $t = -1.37$, $p = .17$. These results are in line with those reported in the main text, which show that Dominance is not reliably associated with Social Attractiveness verbalizations. In the Prestige model, coefficients on gender [$b = -.13$, $t(185) = -.87$, $p = .38$], Intimidation and Entitlement \times gender [$b = -.04$, $t(185) = -.27$, $p = .79$], and Social Attractiveness \times gender [$b = .06$, $t(185) = .36$, $p = .72$] did not differ from zero. These results indicate that men and women signaled their Dominance and Prestige with similar characteristic verbalizations.

association between the Intimidation and Entitlement and Social Attractiveness scales and the various measures of social rank. Three multiple regression models separately predicting peer-perceived influence, outside observer-perceived influence, and behavioral influence from both behavioral scales revealed that all three measures of rank were positively associated with both Intimidation and Entitlement (controlling for Social Attractiveness; β s = .51, .72, and .17, respectively, $t(187)$ s = 8.71, 15.34, and 2.27, all $ps < .05$) and Social Attractiveness (controlling for Intimidation and Entitlement; β s = .27, .17, and .16, respectively, $t(187)$ s = 3.68, 4.71, and 2.24, all $ps < .05$). These findings underscore the importance of discriminating between Dominance and Prestige; the distinct behaviors that uniquely predict each strategy cannot be distinguished at the level of overall social rank or influence. As is shown in Table 6, correlations of each item that constituted the Social Attractiveness and Intimidation and Entitlement scales with Dominance, Prestige, and perceived social influence revealed a similar pattern of results.

4.4 Summary

These results are consistent with Hypothesis 2 and suggest that, despite their shared function in promoting social rank, Dominance and Prestige are underpinned by distinct, characteristic verbal styles. Fine-grained coding of the verbal styles demonstrated by individuals in the social interaction from Chapters 2 and 3 showed that Dominance is associated with displays of verbal styles that signal threat, intimidation, and self-entitlement, whereas Prestige is associated with verbal styles that instead communicate warmth, self-deprecation, and social attractiveness.

Importantly, future research should explore the degree to which the distinct patterns of verbal styles found here, and their unique relations with Dominance and Prestige, reflect

distinctions in verbal content, paralinguistic behaviors (e.g., prosody, pitch, volume, intonation), or postural behaviors. The coding method employed in this study captures differences along all three dimensions, and therefore does not permit us to disentangle these various possibilities. However, our theoretical framework suggests that Dominance and Prestige should be underpinned by distinct ethologies, so as to invoke perceptions of either threat or admiration, and to clearly signal one's preferred strategy in a given relationship and prevent confusion. This line of reasoning suggests that the two strategies may reveal differences in many, if not all, of these domains of speech and nonverbal behavior. Although a comprehensive examination of this issue across all verbal and nonverbal behavioral domains is beyond the scope of the present dissertation, in Chapters 5 and 6 we take the first steps toward a systematic investigation of this issue by isolating and focusing, respectively, on postural behaviors and vocal pitch intonations that uniquely underpin Dominance and Prestige.

Chapter 5: Nonverbal Behavioral Patterns of Dominance and Prestige

5.1 Overview

Chapter 4 demonstrated that Dominance and Prestige are underpinned by distinct suites of characteristic verbal styles. Chapter 5 extends these findings by specifically examining the *nonverbal* behavioral patterns that distinguish between the two strategies. The Dominance-Prestige Account predicts that Dominant individuals should exhibit grandstanding postures and aggressive displays, whereas Prestigious individuals should display confidence but not grandstanding. Unlike Dominants, whose power rests on the evocation of fear and anxiety, Prestigious individuals must *attract* followers, and thus avoid any aggressive behaviors that could cue Dominance. Specifically, we tested the hypothesis that the Dominance behavioral signal should involve spatial expansion, which increases perceived formidability; whereas Prestige should involve more subtle, non-threatening behaviors, such as pride displays, which convey confidence and competence (Hypothesis 3).

More specifically, we expected that the nonverbal behavioral differences between Dominance and Prestige will be manifested as different components of the cross-culturally recognized pride expression (Tracy & Robins, 2008), which was previously found to signal undifferentiated high rank, across cultures (Shariff & Tracy, 2009; Tracy, Shariff, Zhao, & Henrich, 2013). Individuals across a wide range of populations have been found to spontaneously display the prototypical pride expression—arms extended out from the body, expanded posture, head tilted slightly back, chest expanded, small smile—in response to match wins at the Olympic Games judo competition. This finding was replicated in a sample of congenitally blind athletes as well, suggesting that the pride behavioral response to success may

be innate (Tracy & Matsumoto, 2008). Given that victory in an athletic context could implicate either superior physical prowess in an aggressive contest (i.e., Dominance) or high level athletic achievement and skill (i.e., Prestige), it remains unclear which form of rank (or both) is communicated by the pride display.

Henrich and Gil-White (2001) argued that while displaying pride appropriately or in moderation can advertise one's skill and Prestige, overly expansive or aggression-signaling pride displays may signal Dominance, driving out potential followers. Natural selection should thus favor Prestige-seekers who suppress components of the pride display that are spatially expansive, body-enlarging, or aggressive (i.e., that signal Dominance). However, because Prestige-seekers are in competition for the attention and deference of potential social learners, they should display more subtle, non-aggressive components of the pride expression, to advertise confidence (and, by implication, skill) and thereby alert and attract potential followers. It is thus possible that distinct components of the pride display differentially signal Dominance and Prestige. In particular, the more aggressive and spatially expansive movements such as arms extended out from the body and overtly expanded posture may communicate Dominance, while the more subtle and non-threatening movements such as head tilted slightly back, smiling, and mildly expanded chest may communicate Prestige. Indeed, evidence from both humans and nonhumans suggests that Dominants tend to engage in spatially expansive movements (e.g., open arm and leg positions) and claim more personal space than those low in Dominance (Aries, Gold, & Weigel, 1983; Cashdan, 1998; Ellyson & Dovidio, 1985; Henley, 1977; Machotka, 1965; Marsh, Yu, Schechter, & Blair, 2009; Reynolds & Reynolds, 1965; Weisfeld & Beresford, 1982). Correspondingly, the subtle, non-aggressive components of the pride display (e.g., chest

expanded, head tilt up, torso pushed out) have been linked to perceptions of competence, success, and attractiveness (Back, Schmukle, & Egloff, 2010; Weisfeld & Beresford, 1982).

5.2 Method

The video-recordings of group interactions from Chapter 2 again served as the critical stimuli for the present study. To test whether Dominance and Prestige are associated with distinct nonverbal behaviors or components of the pride expression, we sampled behaviors from eight different time points across the 20-min videos. A research assistant blind to the hypotheses selected six segments (each 20-sec in length) from each video, during which a key decision was made by the group. We then added, for all videos, a 20-sec clip from the first moments of the interaction and a 20-sec clip from the final moments (when participants were receiving positive feedback). These two clips were selected because we expected the very beginning of the interaction and the moment when positive feedback was received to be moments when individual differences in Dominance and Prestige would be particularly likely to emerge. Two other research assistants, separate from those who made judgments about verbal styles in Chapter 4, independently watched each 20-sec segment once for each participant (i.e., totaling 3 viewings for videos showing 3 participants seated on one side of the table), focusing on only one participant each time, and coded that participant's nonverbal behaviors. Sound was muted to prevent verbal information (e.g., verbalization content, vocal tone or pitch) from influencing behavioral coding.

Coders rated participants' expression of each of the 5 components of the prototypical pride display that were observable in this situation (i.e., not obstructed by the table or invisible due to participants' seated position) and occurred with any frequency (i.e., "head tilt up", "chest

expanded”, “torso pushed out”, “arms out from body”, “smile”; Tracy & Robins, 2004; 2007a) and 2 other items assessing spatial expansion (i.e., “wide or expansive posture”, “body occupied much space”; see Table 7 for inter-rater reliabilities). Coders rated the intensity of each nonverbal behavior on a scale ranging from 0 (*Not at all present*) to 1 (*Visible but very mild intensity*) to 5 (*Extreme intensity*), based on Tracy and Matsumoto (2008). Coders were instructed to rate the intensity, rather than the frequency, of each movement—meaning that for each 20-sec clip they rated the intensity of the single most intense demonstration of each movement. We focused on intensity rather than frequency because: (a) frequency codes do not account for quantitative differences among ostensibly similar behaviors, and (b) only brief segments of each interaction were sampled, resulting in an inability to accurately code the frequency of behaviors across the full duration of the interactions. Participants’ scores on each behavioral item were computed by summing, within each coder, ratings for that item across all 8 20-sec clips of that participant, then averaging across the 2 coders (i.e., aggregating across the 8 ratings \times 2 coders = 16 observations for each participant). By summing participants’ scores across the 8 clips, we were able to obtain a measure of each participant’s trait-like tendency to display these behaviors from moment to moment, given that participants with highest sums will be those who demonstrated behaviors both more intensely (and thus received a high intensity code within each clip) and did so in more total clips.

However, given that this measure does not allow us to determine whether the intensity or frequency of a particular behavioral display accounts for its effects, we additionally scored behaviors using two other approaches that separate intensity and frequency. Specifically, in the intensity scoring method, a participant’s total score on each behavioral item was computed by aggregating across coders’ ratings on that item, then taking the highest mean rating (i.e., the

maximum score) across all 8 clips, and dropping the other 7 scores, so as to index the maximum intensity with which the participant displayed each behavioral movement across the 8 clips, irrespective of how frequently it was displayed. In the frequency scoring method, a participant's total score on each behavioral item was computed by creating a dichotomized variable that tracked whether the behavioral movement was shown at all (coded 1, regardless of intensity) or not (coded 0) in each clip. These dichotomous codes were then summed across the 8 clips, to capture the frequency with which participants displayed each behavior, irrespective of how intensely it was displayed. In analyzing results, we focused largely on the first scoring method, which takes into account both frequency and intensity, but also examined whether findings varied when using each of the other two methods.

5.3 Results and Discussion

These data were first subjected to a factor analysis to determine how best to scale the specific nonverbal behaviors that were coded from 8 brief moments during the interactions. We conducted an adjusted principal components analysis, with Oblimin rotation on the 7 behavioral items.¹² The scree test again indicated two components: eigenvalues for the first six components were 4.17, 1.48, .75, .31, .15, and .11.¹³ Together, these two components accounted for 72.91% of the variance (55.66% for the first component, and 17.27% for the second component). As shown in Table 7, the four behaviors associated with the more subtle, non-aggressive elements of

¹² Oblimin rotation was used because the two components were significantly correlated, $r = .22, p < .05$.

¹³ I also conducted a confirmatory factor analysis using EQS 6.1 (Bentler, 2003) to compare the fit of the two-factor model with a one-factor model. The one-factor model did not reveal an acceptable fit, $\chi^2(14, N = 191) = 356.30, p < .00001$, CFI = .74, Bollen's (IFI) fit index = .74, RMSEA = .36 (.90 CI [.33, .39]). The two-factor model with correlated factors showed a better fit, $\chi^2(13, N = 191) = 53.02, p < .0001$, CFI = .97, IFI = .97, RMSEA = .13 (.90 CI [.09, .16]). Although the χ^2 and RMSEA were still below optimal levels, this model nevertheless provided a significant improvement over the one-factor model, $\chi^2_{\text{change}}(1, N = 191) = 303.28, p < .0001$.

the pride expression, presumed to signal confidence (i.e., torso pushed out, chest expanded, head tilt up, smile), loaded highly and positively onto the first component and had low cross loadings. All three behaviors presumed to indicate spatial expansiveness (i.e., arms out from body, wide or expansive posture, body occupy space) loaded highly and positively on the second component and had low cross loadings. Accordingly, we labeled the first component “Confidence-Signaling” and the second component “Spatial Expansiveness”. To determine whether these results might be driven by the frequency or intensity of behavioral displays, rather than both, we next conducted separate principal components analyses on the nonverbal behavioral items using the behavioral scoring methods that took into account intensity but not frequency, and frequency but not intensity. In all cases except one,¹⁴ results replicated the main findings, indicating that regardless of whether nonverbal behaviors were scored according to their intensity, frequency, or the two indices combined, these behaviors revealed, quite consistently, two distinct behavioral patterns reflective of Spatial Expansiveness and Confidence-Signaling.

¹⁴ Using the intensity operationalization, 3 of the 4 movements (i.e., chest expanded, torso pushed out, head tilt up) that characterized Confidence-Signaling in the main analysis had high, positive loadings on the first component (ranged from .93 to .80) and low cross-loadings (all < .10); the one exception, smiling, had a higher loading (.63) on the second component and a low cross-loading (-.26). The 3 movements that characterized Spatial Expansiveness in the main analysis (i.e., arms out from body, wide or expansive posture, body occupied much space) had high, positive loadings on the second component (ranged .81 to .78) and low cross-loadings (ranged from .25 to .10). Using the frequency operationalization, the 4 behaviors associated with Confidence-Signaling loaded highly and positively onto the first component (ranged from .98 to .80), and the 3 behaviors associated with Spatial Expansiveness loaded highly and positively onto the second component (ranged from .98 to .83); all behaviors had low cross-loadings (< .10).

Table 7. Nonverbal Behaviors factor loadings and correlations with Dominance and Prestige.

Factor / Item	Factor Loadings			Correlations		
	Inter-Rater Reliability Alphas	Component 1	Component 2	Dominance	Prestige	Perceived Influence
Spatial Expansiveness						
Arms out from body	.81		.90	.26**	.02	.24**
Wide or expansive posture	.73		.83	.17*	.08	.27**
Body occupied much space	.71		.82	.25**	.11	.26**
Confidence-Signaling						
Torso pushed out	.93	.95		.05	.18*	.09
Chest expanded	.94	.89		.07	.18*	.13†
Head tilt up	.91	.87		.07	.18*	.11
Smile	.94	.56		-.02	.28**	.14†

Note. $N = 191$. Factor loadings were generated from an adjusted principal components analysis (with Oblimin rotation) of the 7 items. Loadings below .20 are not presented. Although none of the correlations between the confidence-signaling behavioral items and perceived social influence reached conventional thresholds of statistical significance, the Confidence-Signaling nonverbal composite (computed by aggregating all four items) was significantly associated with higher perceived influence, $r = .44$, $p < .001$.

† $p < .10$ * $p < .05$ ** $p < .01$

We next aggregated, respectively, the 4 Confidence-Signaling items, and the 3 Spatial Expansiveness items (using the main scoring system, which took into account both frequency and intensity), to form two composite measures (both inter-item α s = .90). The two scales correlated .47 ($p < .001$), so we next simultaneously entered both scales as predictors in separate regression models predicting Dominance and Prestige. As was expected, Dominance was positively associated with Spatial Expansiveness (controlling for Confidence-Signaling), $\beta = .33$, $t(187) = 4.16$, $p < .001$, 95%CI [.17, .49], and marginally *negatively* related to Confidence-Signaling (controlling for Spatial Expansiveness), $\beta = -.15$, $t(187) = -1.89$, $p = .06$, 95%CI [-.31, .01]. In contrast, Prestige was positively associated with Confidence-Signaling (controlling for Spatial Expansiveness), $\beta = .22$, $t(187) = 2.82$, $p < .01$, 95%CI [.07, .38], but not significantly related to Spatial Expansiveness (controlling for Confidence-Signaling), $\beta = .01$, $t(187) = .18$, *ns*, 95%CI [-.14, .17].¹⁵

Next, we examined the relations between these two behavioral configurations and rank, with separate multiple regression models predicting peer-perceived social influence, outside observer-perceived social influence, and behavioral influence, from the two behavior scales entered simultaneously. Results indicated that Spatially Expansive behaviors (controlling for Confidence-Signaling) were positively associated with peer-perceived influence, $\beta = .49$, $t(187) = 8.44$, $p < .001$, 95%CI [.38, .60], observer-rated influence, $\beta = .70$, $t(187) = 15.12$, $p < .001$,

¹⁵ To examine potential gender differences, I ran two separate regressions predicting Dominance and Prestige from Spatial Expansiveness, Confidence-Signaling, and Spatial Expansiveness \times gender, and Confidence-Signaling \times gender interaction terms. None of the gender main or interactive effects were significant. Specifically, in the Dominance model, coefficients on gender [$b = -.08$, $t(184) = -.48$, $p = .63$], Spatial Expansiveness \times gender [$b = .03$, $t(184) = .17$, $p = .87$], and Confidence-Signaling \times gender [$b = -.09$, $t(184) = -.47$, $p = .64$] did not differ from zero. Similarly, in the Prestige model, coefficients on gender [$b = -.10$, $t(184) = -.62$, $p = .54$], Spatial Expansiveness \times gender [$b = .25$, $t(184) = 1.47$, $p = .14$], and Confidence-Signaling \times gender [$b = -.06$, $t(184) = -.33$, $p = .74$] did not differ from zero. These results indicate that both men and women signal their Dominance and Prestige with similar nonverbal behavioral movements.

95%CI [.61, .79], and behavioral influence, $\beta = .17$, $t(187) = 2.27$, $p < .05$, 95%CI [.02, .32]. Similarly, Confidence-Signaling behaviors (controlling for Spatial Expansiveness) were positively associated with peer-perceived influence, $\beta = .32$, $t(187) = 5.44$, $p < .001$, 95%CI [.20, .43], and observer-rated influence, $\beta = .22$, $t(187) = 4.71$, $p < .001$, 95%CI [.13, .31], and marginally with behavioral influence, $\beta = .14$, $t(187) = 1.79$, $p = .08$, 95%CI [-.02, .28]. This suggests that judgments of generalized high rank and behavioral influence may be driven by both spatially expansive behaviors and more physically subtle displays of confidence. As displayed in Table 7, the correlations of the individual nonverbal behavioral items with Dominance, Prestige, and perceived social influence showed a similar pattern of results. Taken together, these results indicate that Dominant and Prestigious individuals signaled fear and competence, respectively, through characteristic nonverbal behaviors, consistent with the Dominance-Prestige Account.

5.4 Summary

Chapter 5 showed that Dominance and Prestige are underpinned by distinct nonverbal behavioral patterns. Coding of nonverbal behaviors spontaneously displayed by individuals during the social interaction from Chapters 2 and 3 revealed that, consistent with Hypothesis 3 proposed in Chapter 1, Dominant individuals display spatially expansive and more aggressive postural components of the pride display, whereas Prestigious individuals display non-aggressive, confidence-signaling elements of the pride display.

Together, Chapters 2 and 3 revealed that Dominance and Prestige rank-attaining strategies are each associated with distinct suites of verbal styles and nonverbal behavioral signals. Those who are high in dominance tend to display intimidating and self-entitling verbal styles, such as forcefully pushing for their own opinion and gesturing toward their own

importance, and engaging in spatially expansive and somewhat aggressive postural displays. In contrast, those who are high in prestige tend to display socially attractive verbal styles, such as self-deprecation and seeking others' approval, and engage in confidence-signaling nonverbal movements. These results support previous ethnographic records suggesting that the two strategies are fundamentally distinct avenues to social status, and provide some of the first concrete indications of how individuals signal and communicate their rank strategy. It is likely that the distinct behavioral patterns found here are used by group members, possibly implicitly, to accurately judge whether a peer warrants their respect and admiration, and/or their fear and avoidance. These findings thus offer direct support to Hypotheses 2 and 3, and suggest that Dominance and Prestige are underpinned by distinct ethologies.

Furthermore, by empirically linking Dominance to spatially expansive and aggressive postural movements, and Prestige to more subtle non-aggressive and confidence-signaling movements, these findings lend support to the theoretical notion that Dominance rank is predicated upon fear and formidability whereas Prestige is predicated upon perceived competence and respect. Chapter 6 complements Chapters 4 and 5, and turns from exploring verbal styles and postural behaviors to examine the distinction between Dominance and Prestige in the vocal domain, specifically focusing on how the two rank processes are differentially signaled via changes in vocal pitch.

Chapter 6: Vocal Pitch, Dominance, and Prestige

6.1 Overview

While Chapters 4-5 have identified the verbal styles and nonverbal behaviors displayed by humans when they compete for social rank, little is known about other relevant adaptations that facilitate rank contests. Despite the essential roles of verbal styles and nonverbal behavioral changes for revealing asymmetries in formidability and competence, there are many occasions in which extensive verbal exchanges do not occur (particularly with Dominant, aggressive others) and visual cues are not effective due to distance, darkness, or obscuration by clothing and other objects (Sell et al., 2008). Such limitations would likely have selected for supplemental signaling systems that complemented verbal content and postural displays but that do not rely on language or sight, such as vocal signals communicated via the auditory channel. Despite vast research indicating that many non-human species—including chimpanzees and baboons—emit characteristic auditory cues during dominance contests (e.g., Kitchen, Seyfarth, Fischer, & Cheney, 2003; Slocombe, & Zuberbühler, 2007), little is known about the vocal changes that occur in humans when they are vying for rank. Do humans, too, display observable vocal changes when seeking to exaggerate their formidability in rank contests? In Chapter 6 I turn to the vocal channel of communication, and specifically tested whether Dominant individuals exaggerate their formidability by lowering their vocal pitch, and this lowered pitch contributes to their attainment of social rank. Specifically, as laid out in Chapter 1, we predicted that individuals who lower their pitch in the first minutes of a group interaction will gain greater perceived Dominance in the eyes of group members, which in turn will predict higher emergent social rank in the group. In contrast because Prestige rests on perceived competence and

attractiveness rather than formidability, we did not expect Prestige to vary systematically with alterations in pitch (Hypothesis 4).

Multiple lines of evidence suggest that vocal pitch is linked to dominance. First, studies indicate that vocal pitch is perceived as communicating strength. Both men and women rate lowered male voices as reflecting larger size and greater physical strength and social dominance (e.g., Feinberg, Jones, Little, Burt, & Perrett, 2005; Puts, Gaulin, Verdolini, 2006; Puts, Hodges, Cárdenas, & Gaulin, 2007). Second, neuroendocrinological and anatomical evidence supports the view that lower pitched voices are linked to dominance and higher pitched voices to subordination. Men with lower vocal pitch tend to have higher circulating testosterone (Dabbs & Mallinger, 1999; Evans, Neave, Wakelin, & Hamilton, 2008; Puts, Apicella, & Cárdenas, 2011), which is associated with aggression and dominance (Archer, 1991; Ramirez, 2003). In contrast, fear—which can be an indicator of subordination—increases tension on the vocal cords, lengthens the vocal folds, and thereby promotes elevations in pitch (Banse & Scherer, 1996). Third, in the only prior study to examine within-person changes in vocal pitch, Puts and colleagues (2006) found that men who viewed themselves as physically stronger than another man, with whom they were competing, tended to lower their pitch when addressing their competitor. In contrast, men who viewed themselves as physically weaker raised their pitch. These findings indicate that pitch may be modulated by an assessment of one's own formidability relative to that of an adversary, and might be used to shape subsequent domination and deference outcomes.

Although much of this work has generally focused on the link between pitch and the perceived threat of male targets, with little research addressing whether pitch alters the apparent formidability of female targets, several studies are suggestive of similar effects in women. For

example, listeners of both genders rate lower male and female voices as more dominant, and likely to be vocalized by physically larger individuals (Barkowska & Pawlowski, 2011; Pisanski & Rendall, 2011).¹⁶ In addition, listeners of both genders express a greater desire to vote for both male and female political candidates with lower voices (Klofstad, Anderson, & Peters, 2012). Finally, lowering the voice leads to increases in subjective feelings of power and dominance in both men and women (Stel, van Dijk, Smith, van Dijk, & Djalal, 2012), which may in turn motivate dominant behaviors.

Building on this research, we tested two predictions emerging from the Dominance-Prestige Account. First, individuals who lower their vocal pitch during the course of a social interaction should be seen as more Dominant but not more Prestigious. Given prior research suggesting that individuals typically display rank signals (i.e., exaggerated cues of their formidability) during initial face-to-face encounters (i.e., before asymmetries are determined; Bass, 1981), we focused on changes in vocal pitch over the first few minutes of a social interaction. Specifically, we tested this prediction by tracking shifts in vocal pitch exhibited by individuals working collaboratively in the small face-to-face groups reported in Chapters 2 and 3, and then examined whether the alterations in pitch that emerged were systematically associated with Dominance and Prestige.

Our second prediction is that individuals who deepen their vocal pitch over the first minutes of a group interaction should emerge as highly ranked group members, and the link

¹⁶ One gender difference that has consistently emerged is in attractiveness ratings. Female listeners generally rate male speakers with lower pitched voices as more attractive, whereas male listeners rate female speakers with *higher* pitched voices as more attractive (Barkowska & Pawlowski, 2011; Feinberg, DeBruine, Jones, & Perrett, 2008; Pisanski & Rendall, 2011; Re, O'Connor, Bennett, & Feinberg, 2012). This pattern is consistent with other findings suggesting that high rank is more closely linked to attractiveness in men than in women (Cicone & Ruble, 1978; Rainville & Gallagher, 1990).

between lowered vocal pitch and social rank should be mediated by increased perceptions of Dominance but not by perceptions of Prestige. To test this prediction, we used three measures of social rank, taken from Chapter 2: group member ratings of influence, outside observer ratings of influence, and actual impact over the group's decision-making. Importantly, this latter behavioral index of rank moved beyond most prior relevant research, which focused primarily on the impact of vocal pitch on mere *perceptions* of rank (e.g., Borkowska & Pawlowski, 2011; Feinberg et al., 2005; Klofstad et al., 2012; Puts et al., 2006; 2007), and afforded the opportunity to examine how vocal changes affect a *behavioral* indicator of influence over group members. Support for these predictions would provide the first evidence that, during rank competitions, humans spontaneously display non-visual, vocal cues of formidability, which influence their subsequent success at acquiring Dominance and shape hierarchical relationships.

6.2 Method

The video-recordings of group interactions described in Chapter 2 served as the critical stimuli for the present study. However, although 191 participants took part in Chapter 2, vocal pitch data were not available for 40 participants who either spoke too quietly, did not speak for the entire interaction, or had pitch estimates that were outside the typical observed range for their gender. Thus, the present study included the remaining 151 participants whose vocal pitch was detectible. It should be noted that the 40 participants whose data were not available are likely to be predominantly low in Dominance and/or influence, resulting in more restricted variability on both variables. Thus, the exclusion of these participants likely presents a tougher test of our hypothesis.

An audio track was created for each group session from the video-recording, and saved as an uncompressed ‘wave’ file with 44.1 kHz sampling rate and 16-bit quantization. Status signals tend to be displayed early on in social encounters, when groups are initially forming and before hierarchies stabilize (Bass, 1981; Mazur, 1985; Savin-Williams, 1979). For this reason, we examined participants’ unscripted, spontaneous speech at the beginning of the group task, by sampling each participant’s first and third utterances, which were spoken, on average, at 3.23 and 6.11 minutes into the 20-minute task. An utterance was defined as an uninterrupted speech segment lasting 40-ms or longer. This short time frame was chosen because many participants spoke only very briefly at the beginning of the task. Utterances that were part of a question statement were excluded to prevent their characteristic rising intonations from biasing pitch parameters.

The pitch of each utterance was analyzed using the PRAAT phonetic analysis software version 5.3.39 (Boersma & Weenink, 2013). To index change in vocal pitch over time, we quantified the difference in pitch between these two utterances by subtracting the pitch of the participant’s first utterance from that of the third utterance. Substantial individual differences emerged in both the direction and magnitude of change (see Table 8 for descriptive). There were no significant gender mean difference in mean change in pitch, $t(149) = .04, p = .97$, or in any other analyses presented below, so all results are collapsed across gender.¹⁷

Social rank was measured with the three indices from Chapter 2: group member ratings of influence, outside observer ratings of influence, and decision-making impact. Similarly, as

¹⁷ Changes in vocal pitch were unrelated to height (men: $r = .02, p = .85$; women: $r = -.12, p = .27$) and weight (men: $r = -.10, p = .43$; women: $r = -.18, p = .13$) in the present sample.

described in Chapter 2, the perceived Dominance and Prestige of each group member was assessed with group members' ratings.

6.3 Results and Discussion

6.3.1 Is Lowered Vocal Pitch Associated with Greater Dominance (but not Prestige)?

Table 8 presents means, standard deviations, and correlations among variables. Consistent with our first prediction, changes in vocal pitch were significantly and negatively correlated with Dominance ($p < .01$), but not with Prestige ($p = .83$; see Figure 3). These results thus indicate that alterations in vocal pitch over the initial minutes of the interaction systematically predicted Dominance standing over the course of the 20-minute task.¹⁸ Individuals who deepened their pitch were more likely to be seen as possessing greater Dominance.¹⁹

¹⁸ Because of the unscripted, spontaneous nature of the conversations examined, the two vocal samples on which the assessment of change in pitch was based on were produced at different time points for each participant. As a result, the elapsed time between the two vocal samples differed between participants ($M = 3.21$ min, $SD = 3.49$ min). However, elapsed time between vocal samples was uncorrelated with change in pitch ($r = -.002$, $p = .98$), and, in checking, all effects hold after controlling for elapsed time.

¹⁹ In regression model predicting perceived Dominance from change in pitch, gender (dummy coded), and change in pitch \times gender interaction, neither the gender [$b = -.19$, $t(147) = -1.45$, $p = .15$] nor the pitch \times gender interaction [$b = -.002$, $t(147) = -.32$, $p = .75$] terms reached statistical significance. These results indicate the absence of significant gender differences in the relation between lowering pitch and dominance.

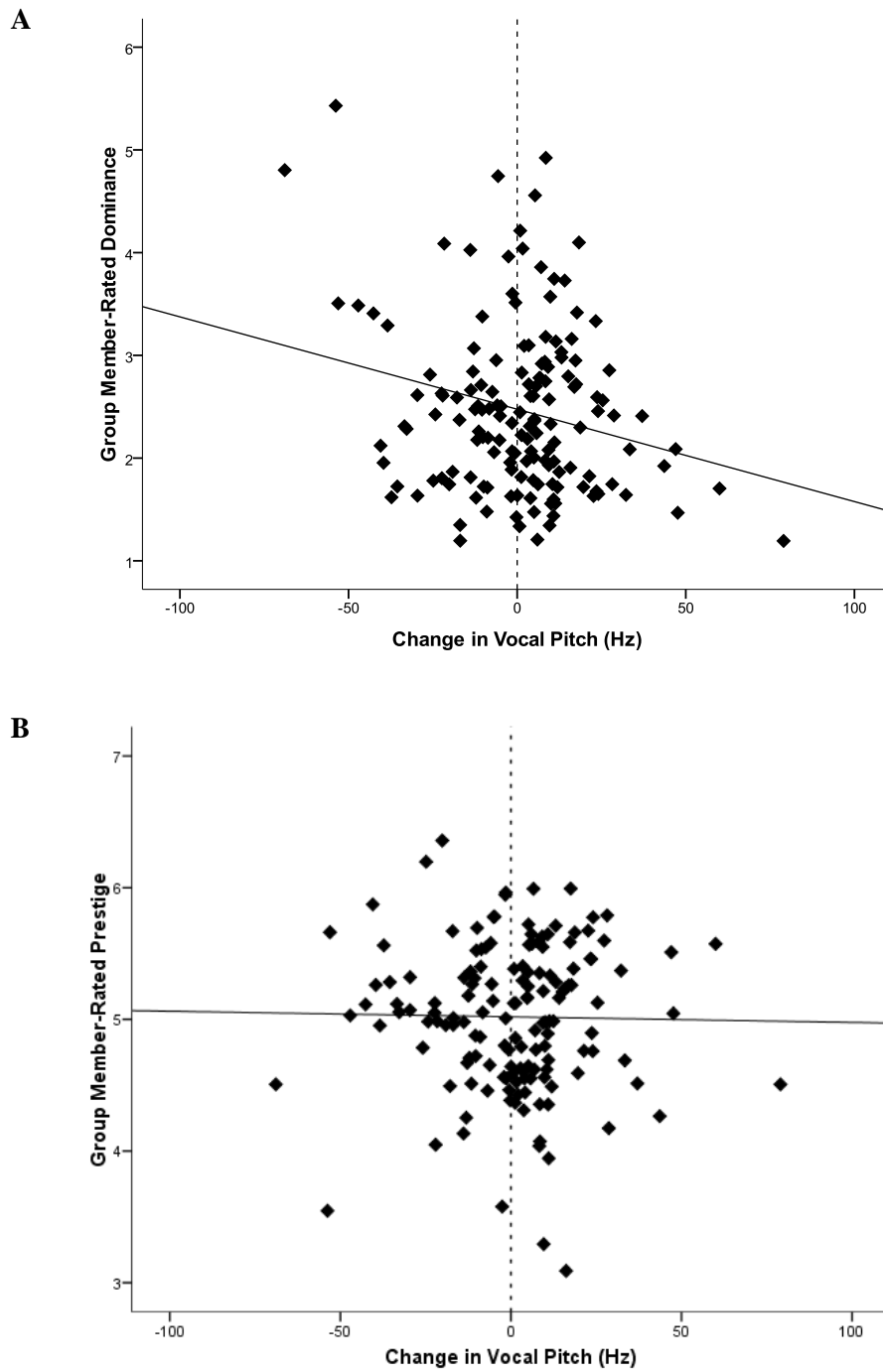
Table 8. Descriptive statistics and correlations among vocal pitch, Dominance, Prestige, and social influence.

	Mean	SD	Minimum	Maximum	Change in Vocal Pitch (Hz)	Pitch of 1 st utterance (Hz)	Pitch of 3 rd utterance (Hz)	Dominance	Prestige	Group member- rated influence	Outside observer- rated influence	Decision- making impact
Change in Vocal Pitch (Hz)	.62	21.19	-68.91	79.00	-	-	-	-	-	-	-	-
Pitch of 1 st utterance (Hz)					-.21**	-	-	-	-	-	-	-
Men	115.76	17.00	79.46	169.81								
Women	208.34	24.76	163.91	277.05								
Pitch of 3 rd utterance (Hz)					.21*	.91**	-	-	-	-	-	-
Men	115.89	13.18	91.03	148.00								
Women	208.77	27.54	155.78	285.70								
Dominance	2.33	.81	1.19	5.43	-.23**	-.07	-.17*	-	-	-	-	-
Prestige	4.93	.62	3.09	6.36	-.02	.06	.06	-.17*	-	-	-	-
Group member- rated influence	4.35	1.03	1.59	6.76	-.20*	.07	-.01	.63**	.46**	-	-	-
Outside observer- rated influence	3.04	.87	1.00	5.00	-.32**	.05	-.08	.50**	.21*	.66**	-	-
Decision- making impact	-36.99	12.81	-84.00	-8.00	-.34**	.20*	.06	.14†	.05	.14†	.22**	-

Note. $N = 151$.

† $p < .10$; * $p < .05$; ** $p < .01$.

Figure 3. Scatter plots (with best-fitting regression line) of (A) Dominance and (B) Prestige as a function of change in vocal pitch.



6.3.2 Do Perceptions of Dominance (but not Prestige) Mediate the Link between Lowered Vocal Pitch and Higher Social Rank?

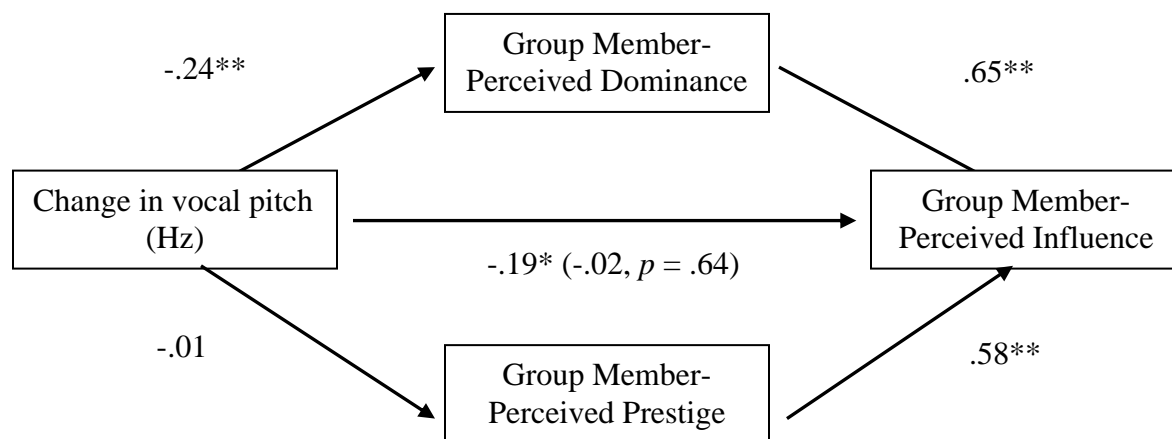
Preliminary analyses indicated that changes in vocal pitch were significantly and negatively correlated with each of the three indices of social rank: group member ratings of influence ($p = .02$), outside observer ratings of influence ($p < .001$), and decision-making impact ($p < .001$). These results suggest that individuals who deepened their pitch were indeed more likely to emerge as influential leaders, whereas those who raised their pitch tended to emerge as deferential followers.

To directly test our second prediction that Dominance perceptions, but not Prestige perceptions, should explain the link between changes in vocal pitch and rank outcome, we tested whether group member-rated Dominance and group-member rated Prestige each mediated the effect of pitch change on social rank. To directly compare the mediating effects of Dominance and Prestige, we estimated the effects of both variables simultaneously in a multiple mediation model (see Preacher & Hayes, 2008), predicting each of the three measures of social rank in turn. Results from the first model, predicting group-member ratings of influence, were consistent with our prediction. Lowering of voice predicted greater perceived Dominance ($\beta = -.23$, $t = -2.89$, $p = .004$), which in turn predicted greater group member-rated influence (controlling for change in pitch and perceived Prestige; $\beta = .65$, $t = 15.63$, $p < .0001$), whereas, as predicted, changes in pitch were unrelated to perceived Prestige ($\beta = -.01$, $t = -.20$, $p = .85$). Further, bias-corrected bootstrap analyses with 5,000 resamples indicated that perceived Dominance significantly mediated this relation, indirect effect [$\beta = -.15$, 95% CI $(-.27, -.03)$]; but perceived Prestige did not, indirect effect [$\beta = -.01$, 95% CI $(-.10, .09)$]. The direct effect of vocal pitch change on rank (after controlling for perceptions of Dominance and Prestige) was non-significant ($\beta = -.02$, $t = -$

.47, $p = .64$), suggesting that the relation between changes in vocal pitch and rank was fully mediated by group members' perceptions of Dominance (see Figure 4). In addition, a pairwise contrast of the two indirect effects revealed that the mediating effect of Dominance was significantly stronger than that of Prestige ($\beta = -.14$, $t = -1.94$, $p = .05$), consistent with our prediction.

Figure 4. Simultaneous mediation model: Effects of Dominance and Prestige in mediating the relation between change in vocal pitch and social influence.

Values are standardized regression coefficients, β s. * $p < .05$; ** $p < .01$.



This pattern was replicated in the second model, predicting outside observer ratings of influence. Lowering of voice predicted greater perceived Dominance in the eyes of group members (as in the first model; $\beta = -.23$, $t = -2.89$, $p = .004$), but was unrelated to perceived Prestige ($\beta = -.01$, $t = -.20$, $p = .85$). Perceptions of Dominance in turn predicted greater outside observer-rated influence (controlling for change in pitch and perceived Prestige; $\beta = .42$, $t = 7.22$, $p < .0001$). Bias-corrected bootstrap analyses with 5,000 resamples indicated that the indirect

effect of perceived Dominance differed significantly from zero, $\beta = -.10$, 95% CI $(-.18, -.02)$, whereas that of perceived Prestige did not, $\beta = -.00$, 95% CI $(-.04, .04)$. The direct effect of vocal pitch change on rank (after controlling for perceptions of Dominance and Prestige) was reduced in magnitude, but still significant ($\beta = -.18$, $t = -2.99$, $p < .01$), suggesting that the relation between changes in vocal pitch and outside observer-rated influence was partially mediated by group members' perceptions of Dominance. Further, a pairwise contrast of these two indirect effects indicated that the mediating effect of Dominance was significantly greater than that of Prestige, $\beta = -.10$, $t = -2.14$, $p = .03$.

However, in the third model, predicting the decision-making impact measure of rank, Dominance was not a significant mediator. Although changes in pitch predicted greater perceived Dominance (as in previous models; $\beta = -.23$, $t = -2.89$, $p = .004$), perceived Dominance did not significantly predict greater decision-making impact (after controlling for change in pitch; $\beta = .07$, $t = .95$, $p = .35$). Bias-corrected bootstrap analyses with 5,000 resamples indicated that although the effect was in the predicted direction, the indirect effect associated with perceived Dominance was not significantly different from zero, indirect effect $\beta = -.02$, 95% CI $(-.07, .01)$. This result is perhaps not entirely surprising, given that the behavioral measure of social rank had the weakest association with perceived Dominance ($r = .18$, $p = .03$), compared to group member ratings of influence ($r = .63$, $p < .001$) and outside observer ratings of influence ($r = .50$, $p < .001$). As in previous models, lowering of voice was unrelated to perceived Prestige ($\beta = -.02$, $t = -.21$, $p = .83$), which was in turn unrelated to decision-making impact ($\beta = .06$, $t = .73$, $p = .46$); the indirect effect of perceived Prestige did not differ from zero $\beta = -.001$, 95% CI $(-.03, .01)$.

Finally, we explored whether individuals' habitual, baseline pitch levels (in contrast to *change* in pitch examined above) predicted rank. As can be seen from Table 8, no consistent relation emerged between mean pitch and emergent rank; pitch of the first and third utterances did not reliably correlate with the three measures of rank, with the exception of a significant *positive* correlation between pitch of the first utterance and behavioral influence, indicating that those with higher pitch in their first utterance had greater impact. These findings suggest that in a face-to-face context, dynamic changes in pitch, rather than baseline pitch level, most reliably predict hierarchy outcomes. That baseline, habitual pitch may be less deterministic of rank than modulated pitch highlights the potency of situational, context-specific influences on hierarchy formation and rank-related behaviors.²⁰

6.4 Summary

Chapter 6 investigated the link between changes in vocal pitch and perceptions of Dominance and Prestige, and emergent social rank. As predicted in Hypothesis 4, individuals who deepen their vocal pitch during the first moments of a group interaction came to be perceived as more Dominant by fellow group members (but not as more Prestigious). Perceptions of heightened threat and formidability in turn predicted increased social rank and influence in the group's hierarchy. Together, these findings complement those from Chapters 4 and 5, and indicate that Dominance and Prestige are signaled via distinct ethological behaviors in the verbal and nonverbal domain, and also the vocal, paralinguistic channel of communication.

²⁰ Interestingly, *raising* of vocal pitch was associated with greater perceived communion, or warmth (Wiggins, 1979; $r = .17, p < .05$).

These findings are particularly noteworthy for several reasons. First, the finding that changes in pitch predict rank consistently across three distinct measures of influence attests to the robustness of the effect. Second, pitch parameters were derived from very brief 40-ms vocalization samples, a briefer time frame than that examined in most prior studies of pitch. The finding that high- and low-ranking individuals could be distinguished via changes in pitch across these very brief samples suggests that the human voice is a powerful and immediate signal of rank. Third, the present work is highly ecologically valid, compared to the majority of prior research on the voice, which has focused on impressionistic judgments formed from pre-recorded, scripted passages (e.g., Feinberg et al., 2005; Klofstad et al., 2012; Pisanski, Mishra, & Rendall, 2012). By moving beyond this approach to assess unscripted, spontaneously generated vocalizations that occur in face-to-face interactions, the present research indicates that pitch predicts rank outcomes in real-world situations of hierarchy formation.

Beyond their relevance to the Dominance-Prestige Account, these findings have several implications for our understanding of nonverbal cues and determinants of social rank. First, the finding that changes in vocal pitch predict actual rank outcomes indicates that the human voice—along with other nonverbal behaviors such as postural displays, emotion expressions, and facial characteristics (e.g., Rule & Ambady, 2008; Shariff & Tracy, 2009; Todorov, Mandisodza, Goren, & Hall, 2005)—contain important cues to Dominance and rank relationships. Second, although prior studies indicate that deeper voices invoke perceptions of dominance and leadership capacity (Feinberg et al., 2005; Klofstad et al., 2012; Puts et al., 2006), this is the first longitudinal study to demonstrate that vocal signals can influence emergent rank in face-to-face interactions. In addition, whereas most previous studies on pitch have focused on mean pitch levels, the current findings suggest that dynamic *shifts* in pitch, rather than baseline pitch levels,

most reliably predict outcomes in naturalistic rank competitions. These results are consistent with prior evidence that men signal their competitive intent by dynamically lowering their voice, and that individuals report a greater likelihood of voting for political candidates with lower-pitched voices (Klofstad et al., 2012; Puts et al., 2006; Tigue, Borak, O'Connor, Schandl, & Feinberg, 2012). Building on these previous findings, the present results suggest that, in face-to-face social interactions, individuals exploit this perceptual bias to invoke Dominance by dynamically lowering their pitch.

In summary, the collective findings from Chapters 4-6 offer novel insights into the ethological behavioral signature of Dominance- and Prestige-seekers, and demonstrate that the two rank-attaining strategies are associated with distinct suites of verbal styles, nonverbal behaviors, and vocal signals. Together, these findings suggest that the characteristic ethology of Dominance consists of intimidation-inducing behaviors, including threatening and self-entitling verbal styles, spatially expansive and aggressive postural movements, and a deepening vocal pitch. The ethology of Prestige, in contrast, is geared towards signaling competence and accessibility as cultural model, and consists of displays such as warm and socially attractive verbal styles, and non-aggressive and confidence-signaling postural movements.

Chapter 7: Concluding Remarks

7.1 Summary of Key Findings

The studies reported in this dissertation present the first systematic investigation of the social rank outcomes and ethological patterns associated with Dominance and Prestige, two theorized fundamental pathways to social rank in humans. Using an evolutionary approach, we built on the Dominance-Prestige Account and derived from it four primary hypotheses regarding the rank-promoting function of Dominance and Prestige, and their characteristic verbal styles, nonverbal behavioral patterns, and vocal pitch patterns, as presented in Chapter 1. Specifically, we hypothesized that individuals who effectively pursue Dominance or Prestige should emerge as influential and highly ranked individuals in the social hierarchy (Hypothesis 1). Because Dominance and Prestige inequalities are theorized to be the products of distinct selection pressures—reducing costly aggressive encounters in the former, and facilitating the acquisition of fitness-enhancing cultural information in the latter—the two strategies are theorized to have different underlying characteristic ethological patterns. we predicted that Dominance should motivate the display of verbal styles that communicate threat, intimidation, and self-entitlement, whereas Prestige should motivate verbal styles that demonstrate warmth, self-deprecation, and social attractiveness (Hypothesis 2).

Complementing these divergent verbal patterns, we also expected different nonverbal displays. We predicted that Dominance should be signaled with spatially expansive and more aggressive postural movements, whereas Prestige should be signaled with more subtle postural signs of confidence and competence (Hypothesis 3). Finally, in the vocal domain, we hypothesized that Dominance, but not Prestige, should be associated with lowering of vocal pitch,

so as to augment one's apparent threat and formidability (Hypothesis 4). These specific predictions were tested across Chapters 2-6 using a small groups face-to-face methodology in tandem with fine-grained behavioral coding and vocal pitch analysis.

Chapters 2 and 3 explored whether Dominance and Prestige are distinct yet viable avenues to attaining social rank. Using a multi-method approach—in which social rank was operationalized both as in-lab peers' and outside observers' perceptions of social influence, as well as behavioral influence over decision-making in a collaborative task—Chapter 2 demonstrated that individuals high in Dominance and those high in Prestige (as rated by in-lab peers and outside observers) tend to receive greater influence during a group task. Chapter 3 replicated this finding with rank operationalized as social attention; highly Dominant group members and highly Prestigious group members tend to receive greater visual attention from outside observers than their counterparts who are low on both dimensions. This result was replicated across two measures of visual attention and two sources of Dominance and Prestige perceptions, and held controlling for volubility and seating position. Together, these two studies provide evidence for Hypothesis 1—Dominance and Prestige are each effective strategies for attaining social rank in contemporary human groups, even when Dominant and Prestigious individuals directly compete for rank within the same group.

Chapters 4 – 6 investigated the ethological patterns that underlie Dominance and Prestige and found support for the theoretical distinction between the two strategies across verbal (Chapter 4), nonverbal (Chapter 5), and vocal domains (Chapter 6). Furthermore, the ethological displays found to underpin each strategy are consistent with the theoretical notion that Dominance arises from and is maintained by fear, threat, and compulsion, and that Prestige, in contrast, by respect, admiration, and social learning. Offering support to Hypothesis 2, results

from Chapter 3 demonstrate that Dominance is uniquely associated with verbal styles that communicate intimidation and self-entitlement, such as teasing others in dominant or humiliating ways, forcefully pushing one's own ideas or opinion, gesturing to oneself and one's own importance. In contrast, Prestige is uniquely associated with verbal styles that communicate warmth and social attractiveness, such as teasing others in a flattering way, seeking group consensus, showing self-deprecation, and attributing success to team efforts.

Complementing these results, Chapter 4 showed that the nonverbal behaviors of Dominance and Prestige are similarly distinguished in characteristic ways consistent with Hypothesis 3. We found that Dominance is uniquely associated with spatially expansive postural movements, such as holding arms out from body and wide or expansive postures. In contrast, Prestige is uniquely associated with confidence-signaling nonverbal behaviors, such as chest expansion, torso pushed out, head tilt up, and small smile. That we found evidence for these distinct, theoretically predicted behavioral patterns is particularly noteworthy given that we measured nonverbal behaviors occurring in a total of only 2.67 discontinuous minutes, from a 20-min interaction. This suggests that these distinct behaviors are pervasively displayed by Dominant and Prestigious individuals, and thus likely contribute substantially to Dominants' reputation of using intimidation and threat of force to acquire power, and, conversely, to Prestigious individuals' reputation for being excellent models for cultural learning.

Chapter 6 turned to the vocal domain to examine whether Dominance is associated with lowered vocal pitch. Consistent with Hypothesis 4, individuals who deepen their vocal pitch during the first minutes of a 20-minute group interaction were subsequently seen as more Dominant, but not as more Prestigious. In addition, we found that those who deepen their pitch emerged as more highly ranked group members, as indexed by each of the three measures of

influence taken from Chapter 2: group members' ratings of influence, outside observers' ratings of influence, and decision-making impact. This relation was explained by increased perceptions of Dominance but not by perceptions of Prestige. Overall, these findings suggest that, like the characteristic verbal styles and nonverbal behaviors found to underlie Dominance, deepening vocal pitch is a spontaneously displayed cue of threat and formidability, which subsequently shapes perceptions of Dominance and hierarchical outcomes.

Taken together, these findings offer new insights into the foundations of human social rank, shedding light on the social psychological processes that lead to hierarchical differentiation, as well as their associated ethological patterns. In the remainder of this dissertation, I explore the broader implications and future directions of this research.

7.2 Implications for the Evolutionary Foundations of Human Social Hierarchy

Although previous studies have identified distinct micro-level personality traits and attributes that are associated with Dominance or Prestige (Buttermore, 2006; Cheng et al., 2010; Johnson et al., 2007; Reyes-Garcia et al., 2008), this is the first research to examine the concurrent efficacy of the two strategies for attaining rank and influence. In addition, while previous work examined long-term Dominance and Prestige hierarchies in pre-existing social groups, the present research demonstrates that both hierarchies emerge rapidly among members of short-term, newly acquainted groups who interact for only 20-minutes. The finding that differences along both dimensions emerged spontaneously and reliably in brief social encounters, and that individuals' ranks on each dimension were readily apparent to peers within the group, outside observers, and eye-tracked observers who viewed each interaction for only 120-sec of fragmented moments, suggests that individual differences in the use of these strategies are

fundamental to interpersonal relationships, and that individuals are highly attuned to accurately perceiving these differences.

These findings are also consistent with a large body of research demonstrating high levels of consensus and accuracy in person judgments from only brief observations of “thin sliced” behavior (e.g., Ambady & Rosenthal, 1992; Funder & Colvin, 1988). The present research adds to this literature by demonstrating that Dominance and Prestige, too, can be very quickly and accurately judged. This ability may be shaped by selection pressures on subordinates to monitor and pre-empt attacks from Dominants and maximize opportunities to acquire fitness-enhancing cultural information from Prestigious individuals. Chapter 3 suggests that, in both cases, these quick perceptual abilities may be facilitated by automatic visual attention patterns.

The finding that Dominance and Prestige can coexist within social groups as viable rank-promoting strategies suggests that human social hierarchies are multidimensional. In particular, we found that Dominance is predictive of influence even after controlling for Prestige, suggesting that Dominant individuals do not acquire influence by merely invoking misperceptions of high competence and ability, or by demonstrating social attractiveness (c.f., Anderson & Kilduff, 2009b; Sadalla, Kenrick, & Vershure, 1987). This finding stands in contrast to the competence-based perspective, which maintains that intimidation and aggression are largely ineffectual for rank attainment, and that competence and generosity represent the primary routes to influence (e.g., Anderson & Kilduff, 2009a; 2009b; Barkow, 1975; Ridgeway & Diekema, 1989). Our findings also challenge the conflict-based account of hierarchy, which holds that individuals generally acquire rank by displaying dominance and threat, and underemphasizes the importance of abilities and competence. By supporting the Dominance-Prestige Account, the present findings integrate these two narrower accounts, and thus reconcile

a longstanding division in the literature on human social hierarchies. When considered jointly, Dominance and Prestige explain a substantial portion of variation between individuals in social rank, consistent with the theoretical notion that the two strategies form the core foundations of human hierarchical relations.

These findings also suggest that many of the fairly wide range of narrow attributes and behaviors previously found to be associated with social rank likely captured one of the two fundamental strategies. Specifically, prior evidence for an association between rank and physical strength (Schjelderup-Ebbe, 1935), aggression (Griskevicius et al., 2009), toughness (Cashdan, 1998), threatening and coercive behavior (Kyl-Heku & Buss, 1996), assertiveness (Gibb, 1968; Lord et al., 1986; Stogdill, 1948), need for power (Flynn, Reagans, Amanatullah, & Ames, 2006; Winter, 1988), anger (Tiedens, 2001; Van Kleef, Homan, Beersma, & van Knippenberg, 2010), narcissism (Brunell et al., 2008), and prioritizing self- over group-interest (Maner & Mead, 2010), may be more parsimoniously viewed as reflecting Dominance-based processes. Likewise, evidence for an association between rank and the possession of valuable skills (Berger et al., 1972; Ellis, 1994; Lord et al., 1986), task ability (Driskell et al., 1993), intelligence (Lord et al., 1986; Stogdill, 1948), perceived competence (Anderson & Kilduff, 2009b), specialized knowledge (Mesoudi, 2008; Van Vugt, 2006), altruism (Hardy & Van Vugt, 2006; Willer, 2009), helpfulness (Flynn et al., 2006), generosity, honesty, responsibility, fairness (Lord & Maher, 1991), and charisma (Awamleh & Gardner, 1999) may in fact reflect Prestige processes. The present research is the first to conceptually bring together these seemingly disparate sets of findings into one coherent model, and to provide an empirically supported account that suggests that the competence-based and conflict-based perspectives are not in fact incongruous, but rather that human hierarchical relations are dual faceted.

Distinctions similar to Dominance and Prestige have been made in psychology (e.g., Gilbert, Price, & Allan, 1995; Magee & Galinsky, 2008), sociology (e.g., Kemper, 1990), anthropology (e.g., Krackle, 1978; Barkow, 1975), and zoology (Chance & Jolly, 1970) based on inductive inferences. However, the framework adopted here has several advantages over these earlier models. First, it explains why subordinates in human social groups seem to demonstrate two notably distinct ethological and psychological patterns directed at different high-ranking individuals—copying and deferring to some leaders while avoiding and fearing others, as well as differential patterns of imitation, memory, attention, and persuasion in the presence of these different leaders (for a review, see Henrich & Gil-White, 2001). Second, it explains *why* certain socially attractive qualities (e.g., expertise and success) promote rank. Third, it can account for group and cultural differences in the traits and abilities that lead to high rank; for example, why athletic ability is valued among adolescent boys but not academic scholars. In sum, by positing a cultural learning process to account for Prestige hierarchies and employing evolutionary logic, the Dominance-Prestige Account provides a basis for understanding the distal forces that shape preferences for social models and processes of social influence.

More broadly, our findings lend support to the theoretical account of Prestige as having arisen in response to the evolution of cultural learning capacities in humans. With the emergence of capabilities for acquiring cultural information (e.g., imitation capacity), it likely became adaptive for individuals to acquire such knowledge from skilled social models, resulting in a human psychology in which individuals ingratiate themselves to skilled others by displaying deference. This in turn permits subordinate learners access to Prestigious models, who allow copying and thus exert further influence over learners. Consistent with this account, our results indicate that individuals pay greater attention to Prestigious others (and Dominant others) than

non-Prestigious, and defer to their opinions (as evidenced by the finding that Prestigious individuals scored higher on the behavioral measure of influence in Chapter 2), despite our finding that these individuals, in contrast to Dominants, are not viewed as threatening and are well liked. The present findings are thus compatible with the theory of Prestige as resulting from the evolution of cultural transmission (see Henrich & Gil-White, 2001; Boyd & Richerson, 1985); in our view, this account provides the most parsimonious and empirically supported framework for the extant data.

The present findings also raise questions for accounts of human social hierarchy as being exclusively Prestige-based, having evolved (or “exapted”) from earlier Dominance hierarchies seen in other animals (Barkow, 1975). Given the evidence that emerged here for the prevalence and viability of Dominance, it seems reasonable to conclude that human social stratification is characterized by the co-occurrence of both strategies, even among groups of university students who are presumably more oriented than average toward the attainment of cultural knowledge, and not particularly fearful of threat of force in a laboratory-based situation. Given the importance of competitive contests in virtually all nonhuman animal social hierarchies (Mazur, 1973), Dominance in humans likely represents an evolutionarily ancient system which, despite the rise of Prestige, remains operative. Human Dominance is not, however, limited to physical conflict; in most contemporary societies it is likely more frequently wielded by controlling costs and benefits in non-competitive domains.

One potentially unique feature of human hierarchies is that merit-based institutional positions, which are attained via the demonstration of skill and ability, are typically endowed with the control of costs and benefits, and thus can evoke Dominance-oriented behaviors, resulting in the simultaneous use of both strategies (also see Magee & Galinsky, 2008). Indeed,

in the present as well as previous research (Cheng et al., 2010), Dominance and Prestige were statistically independent, suggesting that individuals could concurrently adopt both strategies, consistent with developmental studies showing that some children simultaneously demonstrate both pro-social and coercive relational styles (Hawley, Little, & Pasupathi, 2002).

Another implication of the present results is that although nonverbal pride displays are common among both Dominant and Prestigious individuals, the specific components of the display engaged by each status strategy seem to differ; these differences may correspond to a difference in the kind of pride Dominant and Prestigious individuals tend to experience. In previous research, we found that Dominance and Prestige are each uniquely related to a different facet of pride; Dominance is associated with the arrogant, egotistical, “hubristic pride”, whereas Prestige is associated with the more pro-social, achievement-oriented “authentic pride” (Cheng et al., 2010). Thus, the present results may indicate that some components of the prototypical, cross-culturally recognized pride expression are more indicative of authentic pride and Prestige, while other components are more indicative of hubristic pride and Dominance. Although prior studies found that the same pride displays, when viewed with no surrounding context, are readily identified as conveying both facets (Tracy & Robins, 2007b), no previous studies have tested for a relation between the behaviors actually displayed by proud individuals and their tendency to experience each facet, or be perceived as high in each status strategy. One important direction for future research, then, is to test whether the distinct behavioral patterns found here are reliably identified with distinctly authentic and hubristic pride experiences.

Finally, the present research also has implications for research on the evolutionary origins of leadership (e.g., Van Vugt, 2006; Gillet, Cartwright, & Van Vugt, 2011). Although we focused more on rank and influence than leadership, effective leadership depends on inducing

social influence (Bass, 1990; Hollander, 1985; Hollander & Julian, 1969), suggesting that Dominance and Prestige may also underpin two alternative styles of leadership. Consistent with this notion, researchers have delineated two contrasting leadership personalities, termed ‘selfish’ and ‘servant’ (Gillet et al., 2011; Greenleaf, 2002; Wilson, Van Vugt, & O’Gorman, 2008). Selfish leaders have been found to exploit their positions of power and take more than followers from a common resource, out of feelings of entitlement. Their behaviors contrast sharply with those of “servant” leaders, who engage in self-sacrificial, altruistic behaviors to promote group cooperation at a cost to themselves (De Cremer & Van Dijk, 2005; Gillet et al., 2011; O’Gorman, Henrich, & Van Vugt, 2009). A similar distinction can be found in studies comparing “autocratic” and “democratic” approaches to leadership (Lewin, Lippit, & White, 1939).

Our findings also shed light on the prevalence of narcissistic, aggressive, and manipulative egotists in leadership roles, such as company presidents and chief executive officers (Brunell et al., 2008; Deluga, 1997; Fast & Chen, 2009; Rosenthal & Pittinsky, 2006; Van Vugt, 2006; Wasylyshyn, 2005; Workplace Bullying Institute & Zogby International, 2010), and the multitude of kings, emperors, tyrants, and dictators who have throughout history exploited their leadership positions for self-benefit at the cost of the group (Betzig, 1993). The influence of these despots may be explained by their effectiveness in deploying a Dominance strategy. These individuals may rely on Dominance-oriented behaviors as a result of insecurities about their ability to attain broadly recognized Prestige; indeed, recent findings suggest that powerful individuals become aggressive when they perceive themselves as incompetent (Fast & Chen, 2009).

7.3 Limitations and Future Directions

One limitation of the present studies is their reliance on a correlational approach, which limits our ability to directly address questions of causality—whether Dominance or Prestige are causal antecedents to social rank. However, given that Dominance and Prestige are latent perceptions constituted from the sum of numerous more specific social attributes, behaviors, and interpersonal traits, manipulating any single attribute would likely be ineffective to promote a genuine, believable Dominant or Prestigious reputation in a face-to-face context. Nevertheless, one important future direction is to directly test the causal model indicated by our theoretical account.

Another important future direction is to examine whether the present findings generalize to stable long-term groups. Previous research suggests that both dimensions exist and can be reliably assessed within such groups (Cheng et al., 2010; Reyes-Garcia et al. 2008; 2009), and that in at least one long-term group (university athletic teams), Dominant individuals and Prestigious individuals are both perceived as leaders by other group members (Cheng et al., 2010). Thus, it seems likely that the present results represent Dominance and Prestige dynamics as they occur in real-world, long-term social hierarchies, but this should be tested in future research.

Given the evolutionary framework of the present research, another limitation is our inclusion of only North American undergraduates, who are often not representative of most of the world's populations (Henrich, Heine, & Norenzayan, 2010). Future studies are needed to replicate these findings in diverse populations, to test whether the rank-promoting effects of Dominance and Prestige generalize across human societies. Previous research is consistent with this expectation; Dominance and Prestige hierarchies have been documented in culturally and

geographically diverse populations, including the Tsimane'—a highly egalitarian population of forager-horticulturalists in the Bolivian Amazon (Reyes-Garcia et al., 2008; 2009; also see von Rueden et al., 2008)—as well as industrialized populations from the United States and Canada (Buttermore, 2006; Cheng et al., 2010; Johnson et al., 2007)—but these studies have not tested whether each of the two strategies, defined in terms of higher order, widely-encompassing reputations—is associated with social rank and influence in these diverse groups.

In conclusion, although the pursuit of social rank is a recurrent, pervasive, and universal feature of human societies, only recently has a parsimonious evolutionary account emerged that can unify the diverse and seemingly contradictory empirical findings regarding rank attainment. The present research provides support for the Dominance-Prestige Account, and demonstrates that while both are effective strategies for ascending the social hierarchy, they are underpinned by divergent interpersonal behaviors and perceptions.

A related future direction involves clarifying the influence of gender, ethnicity, and culture on the pursuit and effective attainment of Dominance and Prestige. A long tradition of work in sociology (e.g., Berger, Rosenholtz, & Zelditch, 1980; Berger, Wagner, & Zelditch, 1985; Eagly, 1983; Meeker & Weitzel-O'Neill, 1985) has shown that characteristics such as gender, race, and other so-called *diffuse status characteristics*—rooted in cultural beliefs and norms—give rise to differential expectations of competence (and by implication, Prestige), which can in turn shape rank-related behaviors and perceptions of rank. This implies that the possession of these characteristics (even when not corroborated by genuine expertise) may predispose individuals to attaining Prestige.

According to this logic, gender stereotypes may lead men and women to pursue Prestige in different task domains. Although the present studies—which focused on same-gender

groups—found no evidence of gender differences in the efficacy of Dominance or Prestige in promoting social rank, it is possible that in a mixed-gender context where men are expected to have greater, and women less, task expertise (e.g., a math task), men may show an increased, and women reduced, tendency to pursue Prestige-based rank and demonstrate a suite of Prestige-related ethological displays. Whereas, in contrast, if the task falls in a stereotypically female domain, women are expected to show a greater desire for, and more displays associated with, Prestige, relative to men. Thus, to the extent that these gender-based expectations increase or decrease one's apparent skill and competence, individuals' (unconscious) willingness to pursue Prestige may be influenced by the group's locally held expectations and beliefs about their abilities. This line of reasoning is corroborated by research demonstrating that, in mixed-gender dyads, men display more rank-related behaviors (e.g., longer speaking time, speech initiation, smiling) than women in stereotypically masculine tasks (e.g., changing automotive oil). In contrast, in a stereotypically feminine task (e.g., sewing), women show more of these rank displays than men (e.g., Dovidio, Brown, Heltman, Ellyson, & Keating, 1987). However, because the verbal and nonverbal behaviors examined in this study reflect generalized high ranking ethological displays, and do not distinguish between Prestige- and Dominance-related patterns, it is possible that these systematic behavioral differences reflect differences between men and women in desire for Dominance as well as Prestige. As such, future research should aim to test whether task domain (and gender stereotypes) uniquely affects Prestige, but not Dominance, ethology in the two genders.

Ethnic membership and cultural norms may similarly give rise to individual differences in both the viability of, and therefore tendency to pursue, Dominance and Prestige. Ethnic-based stereotypes—such as the perception of Asians and Jews as highly competent, hardworking, and

successful (particularly in academic and economic domains; Fiske, Cuddy, Glick, & Xu, 2002; Hurh & Kim, 1989)—may facilitate the effective attainment of Prestige among these individuals in ethnically diverse group settings. Specifically, when information about actual competence is limited or unavailable, these stereotypical expectations of competence are likely to lead group members to perceive these individuals as skilled experts, elevate them to the top of the local Prestige hierarchy, and direct substantial deference and followership-related ethology towards them. Targets of these stereotypes are expected to respond to such deference displays with Prestige-related psychology and ethology, and show increased motivation to further or maintain their Prestige (see Berger et al., 1980; 1985). In converse, the pursuit of Prestige in the local group by members of ethnic groups that are targets of a cultural stereotype characterized by perceived low competence (e.g., Blacks; Alexander, Brewer, & Hermann, 1999; Alexander, Brewer, & Livingston, 2005) may be made particularly difficult by the stigma and expectation of low competence. Unlike individuals from groups for which cultural assumptions of competence is high (and are therefore privileged in their pursuit of Prestige), the level of skill of individuals stigmatized as low in competence is likely to be systematically underestimated. As a result, their attempts to ascend the Prestige hierarchy and attain influence may face more hindrances. All else being equal, compared to group member who evoke cultural perceptions of high competence, those stigmatized as low in competence might be expected to demonstrate even greater expertise and competence, and with higher frequency and persistence, to acquire similar degrees of perceived Prestige.

Another factor that may further impede the Prestige-seeking attempts of group members whose ethnic stereotype evokes expectations of low competence involves fluidity in views of the importance of specific task skills. Studies have shown that individuals tend to devalue and lower

the importance of a skill domain in which their in-group compares unfavorably with a lower status group (e.g., Major & O'Brien, 2005; Schmader, Major, Eccleston, & McCoy, 2001). This raises the possibility that even if a low status, stigmatized group member possessed the relevant skills that are critical to the group's success (and to a greater degree than non-stigmatized others) and is reliably recognized as such, this cognitive bias might lead those in the group to devalue the importance of these skills and underestimate his/her contribution, undermining his/her opportunities to gain Prestige. In summary, future research should directly examine the emergence, viability, and ethological manifestation of Dominance and Prestige in ethnically diverse, as well as mixed-gender, groups to clarify the roles of gender, ethnicity, and culture in shaping rank allocation and rank-related dynamics.

7.4 Final Conclusion

In conclusion, although the pursuit of social rank is a recurrent, pervasive, and universal feature of human societies, only recently has a parsimonious evolutionary account emerged that can unify the diverse and seemingly contradictory empirical findings regarding rank attainment. The present research provides support for the Dominance-Prestige Account, and demonstrates that Dominance and Prestige in fact form the core of human hierarchical relationships, and together represent dual concurrent paths to higher social rank. Despite their shared function in promoting rank, each is underpinned by a distinct set of ethological behaviors, from verbal styles, nonverbal postures, to vocal pitch. On the one hand, Dominant individuals signal fear and intimidation through self-entitling and intimidating verbal styles, spatially expansive postures, and systematic lowering of vocal pitch. Prestigious individuals, on the other hand, garner respect and admiration by displaying socially attractive and warm verbal styles, and non-threatening,

competence-signaling pride-related postures. This dissertation represents the first steps toward a broader investigation into the foundations of human social rank, and highlights the promise of an evolutionary approach for the integrative, theoretically driven study of social rank dynamics.

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