Victorious and Hierarchical:

Past Performance as a Determinant of Team Hierarchical Differentiation

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Abstract

Hierarchies emerge as collectives attempt to organize themselves toward successful performance. Consequently, research has focused on how team hierarchies affect performance. We extend existing models of the hierarchy-performance relationship by adopting an alternative: Performance is not only an output of hierarchy but also a critical input, as teams' hierarchical differentiation may vary based on whether they are succeeding. Integrating research on exploitation and exploration with work on group attributions, we argue that teams engage in exploitation by committing to what they attribute as the cause of their performance success. Specifically, collectives tend to attribute their success to individuals who wielded greater influence within the team; these individuals are consequently granted relatively higher levels of influence, leading to a higher degree of hierarchy. We additionally suggest that the tendency to attribute, and therefore grant more influence, to members believed to be the cause of success is stronger for teams previously higher (vs. lower) in hierarchy, as a higher degree of hierarchical differentiation provides clarity as to which members had a greater impact on the team outcome. We test our hypotheses experimentally with teams engaging in an online judgement task and observationally with teams from the National Basketball Association. Our work makes two primary contributions: (a) altering existing hierarchy-performance models by highlighting performance as both an input and output to hierarchy and (b) extending research on the dynamics of hierarchy beyond individual rank changes toward examining what factors increase or decrease hierarchical differentiation of the team as a whole.

Keywords: hierarchy, teams, performance

Hierarchies refer to vertical differences between members of a group in terms of their possession of a socially valued quality (Anderson and Brown 2010, Berger et al. 1980, Halevy et al. 2011). Although their basis can vary (e.g., influence, resources, or status, Greer et al. 2018, Magee and Galinsky 2008), hierarchies emerge to facilitate effective coordination as collectives pursue common goals (Berger et al. 1980, Simpson et al. 2012, Van Vugt et al. 2008). In hunting and gathering groups, the need to coordinate large-scale tasks gave rise to differentiation in members' influence, thus creating hierarchies (Bernstein 1970, Chase 1980, de Waal 1986). In contemporary groups, the belief that hierarchies facilitate performance and coordination when collective action is needed helps explain the emergence of hierarchical differentiation (Halevy et al. 2011, Kwaadsteniet and Dijk 2010, Zitek and Tiedens 2012). Hierarchies are thus foundational to organizational teams, which consist of "two or more individuals who… possess one or more common goals, are brought together to perform organizationally relevant tasks, and exhibit interdependencies with respect to workflow, goals, and outcomes" (Kozlowski and Ilgen 2006). As they strive to achieve collective goals, teams differentially allocate influence among their members (Anderson and Brown 2010) and a wealth of research has examined how differentiated allocations impact teams' performance (Greer et al. 2018).

Despite the abundance of research, a review of the literature on the relationship between hierarchical differentiation and performance reveals two broad conceptual concerns. First, most hierarchy research predominantly adopts a static perspective in which hierarchies are relatively inert to change (see Bendersky and Pai 2018; Magee and Galinsky 2008). A theoretical byproduct of this perspective is that current models conceptualize performance solely as the output of hierarchy (Greer et al. 2018). This perspective, however, seems incompatible with dynamic conceptualizations of teams performing across multiple cycles (Ancona et al. 2001, Cronin et al. 2011) and with anecdotal evidence of teams actively adapting their patterns of influence in response to differing levels of success (e.g., software development teams at Microsoft; Weinberger 2016). Second, whereas hierarchy dynamics have been explored in terms of changes in individuals' ranks (e.g. Bendersky and Shah 2012, Marr and Thau 2014), this work does not account for dynamics in the structure of the hierarchy itself. Although individual ranks certainly change, prior work often implicitly assumes that the hierarchical differentiation itself is static (i.e. individuals merely switch places in a hierarchy).

We offer an alternative to these assumptions, and make the case that the degree of hierarchical differentiation varies based on teams' past performance. Hence, performance outcomes are not only an output of a team's hierarchical differentiation but also actively shape it. We focus specifically on a team's past performance as a theoretically important starting point because hierarchies exist to facilitate collective success (Greer et al. 2018). Therefore, feedback regarding whether a team is successful may serve as an important signal as to whether hierarchical differentiation varies. Integrating research on exploration and exploitation (Lavie et al. 2010, March 1991) and group performance attributions (Bligh et al. 2011, Hamilton 1978, Weiner 1995), we suggest teams tend to attribute their success to members who had greater impact over team outcomes (Calder 1977, Meindl et al. 1985), and engage in exploitation by committing greater influence toward those individuals believed to be the cause of success (Lavie et al. 2010). This asymmetric allocation of influence suggests performance success results in a higher degree of hierarchy in later performance cycles. Furthermore, we suggest that the tendency to attribute, and therefore grant influence to members believed to be the cause of success, is stronger for teams with a pre-existing higher (vs. lower) degree of hierarchy, as hierarchical differentiation provides clarity regarding which members had greater impact over team outcomes. Overall, we suggest performance success produces a higher degree of hierarchy, and this relationship is stronger among teams with a pre-existing higher degree of hierarchy.

As a result, we make three key contributions. First, we contribute to ongoing research challenging the assumption that hierarchies are relatively static (Bendersky and Pai 2018, Neeley and Dumas 2016, Pettit et al. 2016). Prior models conceptualize performance as an outcome of team hierarchy (Greer et al 2018), whereas our work suggests that performance serves as both an input and output to hierarchical differentiation. As such, we shift the predominantly static focus of current models and move towards an alternative model that considers the dynamic and reciprocal relationship between performance and team hierarchy (Marks et al. 2001). Second, in doing so, we note a broader challenge to existing work on hierarchy. Existing work predominantly examines hierarchy dynamics whereby individuals switch ranks but often neglects to consider broader changes in the team's hierarchical structure and differentiation itself (Bendersky and Pai 2018, Marr et al. 2019, Marr and Thau 2014). We shift the theoretical focus beyond individual changes in rank and highlight the potential for dynamics at the team level. Third, previous work largely portrays hierarchies as self-reinforcing (Berger et al. 1998, Magee and Galinsky 2008, Merton 1968), whereby stable personal characteristics, such as personality and gender, create expectations that shape hierarchies (Anderson et al. 2001, 2008, Anderson and Kilduff 2009, Van Vugt et al. 2008). We extend discussions beyond personal characteristics to include team factors; in particular, we consider the role of teams' prior performance in terms of shaping their hierarchy.

Dynamics in Team Hierarchies

When studying hierarchies, it is helpful to clarify the valued dimension (or basis) of the hierarchy (Greer et al. 2018). We focus on hierarchical differentiation based on influence, or the degree to which some members have a greater capacity to modify the outcomes of a group compared to others (Bales et al. 1951, Berger et al. 1972, Cheng et al. 2013). Specifying influence as the basis of hierarchy is useful in two ways. First, influence is often thought of as a "downstream consequence" of other proxies of hierarchy, such as formal titles, power, or status[1] (Magee and Galinsky 2008). Thus, rather than assuming that influence follows from individual characteristics such as formal titles or rank, focusing directly on influence offers greater precision (Bunderson et al. 2016). Second, although hierarchies based on formal titles and positions can change, influence can be more readily granted or taken away (Bendersky and Shah 2012, Bunderson 2003) and thus better lends itself to discussions concerning hierarchy dynamics.

Nascent work is beginning to unpack the dynamics of hierarchies (Bendersky and Pai 2018, Pettit et al. 2013, Tarakci et al. 2015). Much of this work focuses on the psychological and behavioral

[1] Influence is usually related to both power and status, where individuals high in power or status typically have greater influence over collective outcomes (Anderson et al. 2001). However, status, power, and influence can diverge (Magee and Galinsky 2008) – influential people may not always be respected, and people low in power may actually have great influence (e.g., an administrative assistant with low formal power). Our focus is less on bases of formal power such as rank or job title, which may change infrequently and thus lend themselves poorly to the study of dynamics. Instead, we focus directly on influence (i.e., the ability to modify group outcomes; e.g., Berger et al. 1972; Cheng et al. 2013), which is often perceived as a "downstream consequence" of power and status (Magee and Galinsky 2008).

consequences of rank changes, such as how members react to rising and falling in social rank or influence (Marr and Thau 2014, Neeley 2012, Neeley and Dumas 2016) or to the potential for rank change (e.g., Hays and Bendersky 2015, Pettit et al. 2010, 2016). For example, highly ranked members who face a potential loss in rank feel more threatened by such changes (Jordan et al. 2012, Pettit et al. 2016, Scheepers and Ellemers 2005) and behave more selfishly to protect their positions (Case and Maner 2014). Additional work focuses on how individuals' influence over collective outcomes change as others gain more information about those individuals' abilities (Bendersky and Shah 2012, Bunderson 2003). Earlier sociological work has examined conditions under which rank changes are more likely to occur (Berger et al. 1998, Chizhik et al. 2003, Neeley 2012, Neeley and Dumas 2016, Walker et al. 1986). For instance, hierarchies are more stable when third parties endorse the current rankings (Walker et al. 1986), when there are matches between task and hierarchy structures (Chizhik et al. 2003), and when there are active social sanctions preventing change (Berger et al. 1998). Prior work has thus primarily examined how individuals react to changes in their rank within a hierarchy. However, such work often investigates changes in rank based on the assumption that the structure and differentiation of the hierarchy itself do not change. We offer an alternative perspective, namely that the structure and differentiation of a hierarchy itself may vary, particularly in response to performance outcomes.

Hierarchical Differentiation in Response to Performance

When theorizing about how performance impacts hierarchy, several predictions may exist. For example, whereas success may increase a team's hierarchical differentiation, it is possible that failure could increase a team's hierarchical differentiation as teams "double-down" on existing structures (Staw et al. 1981). Likewise, depending on the basis of hierarchy (e.g., formal power versus influence), failure could lead teams to simply swap individuals' rankings while maintaining the same overall hierarchical differentiation. How might prior performance shape a team's degree of hierarchical differentiation?

To answer this question, we integrate research on exploration and exploitation (Lavie et al. 2010, March 1991), which describes how collectives react to success (vs. failure), and research on group attributions, which describes how collectives assign causes of success (Calder 1977, Hamilton 1978, Weiner 1995). The exploration and exploitation framework is a natural fit because it emphasizes that collectives may change their organizing processes in response to either success or failure (Lavie et al. 2010). Exploitation refers to terms such as commitment and refinement of existing processes, whereas exploration refers to terms such as diversification and experimentation with new processes (Hakonsson et al. 2016, Li et al. 2008). Although a collective's decision to explore or exploit can be determined by a multitude of factors, including environmental dynamism (e.g., Beckman et al. 2004), organizational design (e.g., Csaszar 2013), and past experience in a domain (Eggers and Suh 2018), we rely on this framework because it highlights past performance as the fundamental factor that affects this choice (Lavie et al. 2010).

Our theorizing starts with the premise that collectives exploit what they believe caused their success by allocating resources to it (Lavie et al. 2010). Early theorizing in exploitation and exploration suggests that success signals that the pre-existing process is effective and should be further utilized and refined (Cyert and March 1963, Lant and Montgomery 1987, Lavie et al. 2010). Hence, teams continuously seek improvement by building on what they believe enabled their success; in contrast, when teams fail, they attempt to curtail what they believe caused their failure and try new processes (Gersick and Hackman 1990, Kozlowski et al. 1996, 1999). Following this reasoning, Håkonsson et al. (2016) examined groups performing an origami task and found that groups that were succeeding (vs. failing) were more likely to improve on their current strategy than adopt a new strategy. The literatures on strategic convergence (Tushman and Romanelli 1985) and convergent thinking (Goncalo 2004) also suggest a similar phenomenon whereby groups become "boxed in" by further committing to what led to their success (Audia and Goncalo 2007). Overall, this work suggests that collectives exploit what they perceive to be the cause of their success.

The logical question that then arises concerns what teams believe to be the cause of their performance. Research on group attributions suggests that teams typically look to within-team factors as the cause of performance (Forsyth and Kelley 1994, Hamilton 1978, Rantilla 2000, Weiner 1995). Hence, team members tend to be seen as responsible for a team's performance. Whereas it may be intuitive to believe that blame is passed down to individuals with lower influence, empirical evidence suggests that high-influence members receive more credit *and* blame for a team's outcome. That is, an asymmetry of attribution exists where members who wielded more influence due to their visibility and social expectations of them (Bligh et al. 2011, Zitek and Tiedens 2012) also receive more responsibility for a team's prior outcomes (Calder 1977, Hamilton 1978). Research highlights that high-ranking members, who presumably have a greater influence over a team's outcome, receive more credit following success compared to other potential causes (Meindl et al. 1985, Puffer 1990). Indeed, prior work indicates that, over time, members grant more influence to those who have successfully demonstrated an ability to contribute to the collective's success (Bendersky and Shah 2012, Bunderson 2003). Similarly, when a collective fails, individuals with the most influence are typically blamed for the group's failure (Bligh et al. 2007, Gamson and Scotch 1964). In fact, even when members are aware that they should credit or blame external factors beyond a team's control for their performance, they tend to still assign the majority of responsibility to high-influence members (Weber et al. 2001).

When combined with exploitation and exploration logic, the aforementioned group attributions research suggests that following success, members seen as the cause of that success would be granted higher levels of influence, resulting in a higher degree of hierarchy. By the same logic, following failure, those perceived to be responsible for a team's failure may decline in influence, which could lead to a lower degree of hierarchy. Overall, we suggest that as teams experience success (vs. failure), performance is attributed to specific members, and those members are given relatively higher levels of influence, thereby resulting in a higher degree of hierarchy in subsequent performance cycles.

Whereas our logic is rooted in the exploration and exploitation framework alternative predictions may exist. For example, based on threat rigidity theory (Staw et al. 1981), one may argue that teams experiencing failure (e.g., threat) would rally around a leader, thus potentially creating a higher degree of hierarchical differentiation. However, Staw et al. describe threat in terms of external processes (e.g., bad luck, resource scarcity, or changing environments) rather than processes internal to a group. Indeed, Staw et al. (p. 511) argue that if a failure is attributed to internal deficiencies (rather than external attributions), then support for leadership will decrease. Hence, to the extent that failure is attributed to factors internal to the group as previously discussed, our theorizing is consistent with threat rigidity.

H1: Past team performance is positively related to a higher degree of hierarchy.

A critical question remains: Although teams generally assign responsibility for team performance towards high-influence members (Forsyth and Kelley 1994), are there situations under which such asymmetric attribution of responsibility are more likely to occur? Understanding the conditions under which teams are more likely assign responsibility to high-influence member(s) would help explicate when the effect of past performance on a team's hierarchical differentiation is more pronounced.

We propose that one answer lies in a team's degree of pre-existing hierarchy. The more hierarchically differentiated a team is, the easier it is for members to identify individuals who were highly influential in that team's success/failure. Consistent with this idea, research from psychology suggests that high-rank individuals in groups tend to be more salient (Anderson et al. 2001, Chance 1967), as they are more easily identified in both visual and memory searches (Zitek and Tiedens 2012), and such salient individuals are more likely to be seen as causal agents (Taylor and Fiske 1975, 1978). Indeed, Pfeffer (1977) noted that people more easily attribute a team's prior performance to members with more influence, as attributing a team's outcomes to a few high-influence members is an intuitive model and heuristic for identifying causal relationships in teams. This notion is supported by Meindl et al. (1985), who, across three experiments, found that people were more likely to attribute causality for a collective's outcome to its leader. Thus, to the extent that a higher (versus lower) degree of pre-existing hierarchy makes certain high-influence individuals more salient, it should also be easier for the team to perceive them as having had casual influences over past outcomes, and team members are thus more likely to grant such individuals more influence. As a result, a higher (vs. lower) degree of pre-existing hierarchical differentiation should strengthen the relationship between past performance success (vs. failure) and a team's degree of hierarchy.

H2: A team's pre-existing hierarchy moderates the relationship between past performance and a higher degree of hierarchy, such that the relationship between past performance and hierarchy becomes stronger as the degree of pre-existing hierarchy increases.

Overview of Studies

We utilized experimental and observational methods to test our hypotheses. In a preliminary vignette experiment, we first confirmed our assertion that teams unequally distribute responsibility of a teams' performance success and failure (see Online Appendix). We found that members with the most influence were also assigned the most responsibility for their teams' past performance. We also found that the moderating effect of a teams' pre-existing hierarchy (regarding the relationship between past performance and a teams' degree of hierarchy) was explained by attributions that the person with the most influence caused the teams' past performance. Overall, this provided an initial test of our hypotheses and evidence of our underlying attributional processes. In Study 1, a team behavioral experiment, teams collectively completed a judgement task and experienced success or failure under a pre-existing higher or lower degree of hierarchy. Teams then determined their hierarchical differentiation for the next round of the task. Direct manipulations of our independent variables (i.e., past performance and pre-existing hierarchy) in a controlled experimental context allowed for enhanced internal validity and ability to make causal inferences. In Study 2, we utilized longitudinal data from the National Basketball Association (NBA). This study allowed us to capture hierarchical differentiation in real-world teams using externally valid and unobtrusive behavioral measures, thus increasing the generalizability of our findings.

Study 1: Method

Sample and Procedure

We recruited 735 participants (55.2% female, M_{age} = 40.56) from a pool of Amazon's Mechanical Turk workers managed by the behavioral lab of an American university. We assigned participants to teams of three in a 2 (Pre-existing hierarchy: High vs. Low) x 2 (Performance: Success vs. Failure) between-subjects design (N_{teams} = 245). Since our study required simultaneous online participation, we scheduled sessions. Thus, each day, a randomly selected group of participants from the pool received an email stating that a "team perception game" would take place at a specific time (12PM and 3PM local time). Participants received an email two hours before a given timeslot to notify them when the game would start and a follow-up email five minutes before the start of a session containing the game URL. Through piloting, we found that our servers could handle about 12 simultaneous groups per session (36 participants) before experiencing lag and connectivity-related issues. Thus, we capped each session at 12 groups. Each participant received $2 as payment, and each game lasted approximately 10 minutes. This study was powered by Empirica, a modular virtual experiment platform (Almaatouq et al. 2021).

Task. We adapted an online-networked game from communications research (Moussaïd et al. 2017, 2018). Participants joined virtual rooms in teams of three to complete a judgement task (see Appendix for screenshots). The task involved guessing the overall direction in which 50 dots were moving on a screen, where half of the dots were moving in a common direction and the other half were moving in random directions to create noise. As soon as the dots appeared, participants had 10 seconds to guess in which direction the majority of the dots were moving. Once 10 seconds had passed, another set of dots would be displayed, and participants were again asked to guess the overall direction of the new set of dots. Participants earned points for their team based on how accurately their guesses reflected the overall direction of these moving dots.

However, there were limited opportunities to guess and therefore earn points for the team – for each set of moving dots, only one member's guess could earn points for the team. Since there were only 10 sets of moving dots, there were 10 opportunities to guess (and earn points for the team), which needed to be distributed among members. Hence, guessing opportunities (i.e., opportunities to earn points for the team) were scarce, and teams needed to allocate their guessing opportunities among members in a manner that maximized overall team performance. Thus, much like influence over team outcomes based on speaking time (Cheng et al. 2013) or shot attempts in basketball teams (Halevy et al. 2012), teams needed to determine an allocation that best facilitated performance. We could then examine how past performance affects hierarchical differentiation in terms of this allocation of guessing opportunities.

We explained the rules as follows: 1) For each set of dots, only one participant's guess would count toward the team's performance; 2) the team gains points based on the accuracy of the allotted guesser's guess; 3) there were 10 sets of dots each round (and therefore 10 opportunities to guess and earn points for the team); and 4) during the first round, the 10 opportunities would be randomly distributed, whereas, for the second round, teams could decide how to distribute their 10 opportunities to guess.

In reality, the first round of guesses was allocated in a manner that created a high (vs. low) degree of hierarchical differentiation (our hierarchy manipulation, described below). Moreover, performance feedback was pre-determined and randomly assigned. Therefore, our design involved having teams perform well (vs. poorly) under a pre-existing higher (vs. lower) degree of hierarchical differentiation. Teams then decided how to allocate their guessing opportunities in the second round, and this allocation constituted our dependent variable.

Pre-existing hierarchy manipulation. We told participants that for the first round of the task, a random allocation of guessing opportunities would be selected for them. Teams in the *low pre-existing hierarchy* condition (N = 122) received a relatively equal number of opportunities (i.e., 4, 3, 3); this indicated that none of the three team members had substantially more influence over the team's outcome than the others. Members of teams in the *high pre-existing hierarchy* condition (N = 123) received a relatively unequal number of opportunities (i.e., 6, 2, 2); this indicated that one of the three team members had substantially more influence over the team's outcome. Across *both conditions*, teams decided how to assign the number of opportunities among the three members (based on the given allocation). Specifically, participants viewed three options describing who would receive the most guesses (see Figure A1 in Appendix). Teams needed to decide between three options – Option A meant Player A received the most opportunities [4, 3, 3 or 6, 2, 2], Option B meant Player B received the most opportunities [3, 4, 3 or 2, 6, 2], and Option C meant Player C received the most opportunities [3, 3, 4 or 2, 2, 6]. Participants used a built-in chat platform to vote on which option they wanted, and when teams reached a unanimous decision on how opportunities should be allocated, the task began.

Past performance manipulation. Teams completed guesses on 10 sets of moving dots based on their selected distribution. Performance feedback was only provided after the 10 guesses were completed. Teams were given a percentile feedback for their score. In the *success condition* (N = 122), we told teams that they were performing in the 79th percentile compared to other teams. In the *failure condition* (N =

123), we told teams that they were performing in the 31^{st} percentile.

Manipulation checks. Participants answered manipulation check items for their hierarchical differentiation (i.e., "My team's guesses were ___ distributed"; 1 = *Equally*; 5 = *Unequally*; "One person on my team had substantially more guesses"; 1 = *Disagree*; 5 = *Agree*) and performance (i.e., "My team performed ___"; 1 = *Poorly*; 5 = *Well*; "My team scored in a __ percentile"; 1 = *Low*; 5 = *High*) manipulations. We calculated each team's mean-level response for the manipulation check and ran 2 x 2 ANOVAs to assess team-level average responses to the performance and hierarchy manipulation checks. For the hierarchy manipulation check, teams in the high pre-existing hierarchy condition reported greater hierarchical differentiation (M = 4.11, SD = 0.74) than teams in the low pre-existing hierarchy condition (M = 2.46, SD = 0.74; $F(1, 242)$ = 606.311, p < .001); there was no difference when teams experienced success (M = 3.24, SD = 0.74) or failure (M = 3.33, SD = 0.74; $F(1, 242)$ = 1.781, p = .183) and no interaction ($F(1, 241)$ = 0.705, p = .402). For the performance manipulation check, teams in the success condition reported greater success (M = 3.57, SD = 0.83) than teams in the failure condition (M = 2.11, SD = 0.83; $F(1, 242)$ = 380.234, p < .001); there was no difference between high pre-existing hierarchy (M = 2.87, SD = 0.83) or low pre-existing hierarchy (M = 2.81, SD = 0.83; $F(1, 242)$ = 0.521, p = .471) and no interaction ($F(1, 241)$ = 0.394, p = .531). Hence, our manipulations worked as intended.

Hierarchy choice. After completing the first round and receiving feedback, participants indicated their allocation preferences for the second round by indicating how many guessing opportunities they thought each person should receive (i.e., Person A should receive ___ guesses; Person B should receive __ guesses; Person C should receive ___ guesses; see Figure B1). Participants could indicate any distribution, with the only limitation being that the sum must equal 10. Thereafter, participants were brought to another chat screen and asked to vote on a team allocation for the second round. Each participant's hierarchy preferences were piped in and anonymously displayed, and participants could vote on which distribution they preferred. Members had to come to a common consensus before advancing.

Once a consensus was reached, we informed participants that the experiment was over.[2]

To calculate hierarchical differentiation, we used the standard deviation (SD), coefficient of variation (CV), and Gini coefficient (GC) of each team's consensus as to the allocation of guessing opportunities. These three metrics represent common measures for differentiation (Greer et al. 2018). As teams only had three members, the three scores were nearly perfectly correlated (r = .99 to 1.00). For brevity, we report results only with SD (Halevy et al. 2012), but results are identical across measures.

Study 1: Results

Descriptive statistics and correlations are displayed in Table 1. Looking at the descriptive statistics, we note that teams with low pre-existing hierarchy tended to become more hierarchical (the average SD of guessing opportunities moved from 0.57 to 0.72), whereas teams high in pre-existing hierarchy tended to become less hierarchical (the average SD of guessing opportunities moved from 2.31 to 0.99). This change, in the absolute sense, is likely due to the extreme conditions in our experiment – a distribution where a team is nearly perfectly equal (as in the low pre-existing hierarchy condition) and where a single individual holds 60% of the influence over a team's outcome (as in the high pre-existing hierarchy condition) is likely unusual.

Nonetheless, this experiment allowed us to test whether teams tended to choose a higher degree of hierarchy following success (vs. failure). We conducted ANOVAs, using the hierarchy and performance conditions and their interaction, on a team's choice for hierarchical differentiation (see Table 2, Figure 1a). Results supported H1: There was a positive main effect such that success (vs. failure) led to a high degree of hierarchy ($F(1, 242) = 5.611$, $p = .018$). We also found a significant interaction between conditions ($F(1, 241) = 10.191$, $p = .002$). Pairwise comparisons supported H2: Among teams with a higher pre-existing degree of hierarchy, success (vs. failure) led to a higher degree of hierarchy ($t(241)$ =

[2] Participants did not complete a second round. Nonetheless, we communicated that there would be two rounds, and participants' decisions thus had a meaningful impact on the team's future. During pilot testing, we found that attrition (i.e., participants exiting the experiment) increased with study length. As highlighted by Arechar et al. (2018), the impact of attrition is compounded in networked studies. That is, in a study involving teams of three, a 10% attrition rate may result in up to 30% of teams not completing the experiment. We found that shortening the study and increasing payment decreased attrition rates. In our sample, 49 teams experienced some attrition, and this attrition rate did not differ by conditions. If one person stopped responding, the entire session could not be completed, and the data was not included in the analysis.

3.975, $p < .001$); among teams with lower pre-existing degree of hierarchy, success (vs. failure) was unrelated to hierarchy ($t(241) = 0.547$, $p = .947$). Thus, the effect of past performance was stronger among teams with a pre-existing higher (vs. lower) degree of hierarchy.

Allocation of guessing opportunities to high influence individuals. Our logic suggests that success (vs. failure) leads to a higher degree of hierarchy because credit (and subsequent influence) is disproportionately given to members perceived to have had greater influence over a team's success. We operationalized the members who had greater influence over outcomes by tracking to whom the most guessing opportunities were assigned (4 in the low hierarchy condition; 6 in the high hierarchy condition). We then observed whether these influential members were assigned a relatively high number of opportunities following success versus failure. We conducted an ANOVA on the number of guessing opportunities assigned to the individual who previously had the greatest influence (see Figure 1b). We found a positive main effect for past performance: The individual who was assigned the most opportunities in the first round was assigned the highest number of opportunities following success as compared to failure ($F(1, 242) = 30.743$, $p < .001$). There was also a main effect of pre-existing hierarchy where, regardless of performance, teams with pre-existing high hierarchy assigned more guessing opportunities to the most influential member as compared to teams with low pre-existing hierarchy ($F(1, 242) = 5.843$, $p = .016$). We also found a significant interaction ($F(1, 241) = 8.313$, $p = .005$), and pairwise comparisons indicated that the member assigned the most guessing opportunities during the first round was assigned greater opportunities following success (vs. failure) when pre-existing hierarchy was high ($t(241) = 6.029$, $p < .001$) compared to low ($t(242) = 1.936$, $p = .054$). This pattern is consistent with our arguments: Members with greater influence over outcomes are given the highest level of influence following success (vs. failure), especially in teams with a higher (vs. lower) pre-existing hierarchy.

Study 1: Discussion

In Study 1, we developed a networked game to capture hierarchical differentiation in terms of allocation of influence over team outcomes. We created a context that matched the pre-conditions of our theory: Teams experienced success (vs. failure), and members could attribute their team's success and failure by examining their pre-existing hierarchical differentiation in influence. We then gave teams agency over the shape of their hierarchies (i.e., how to allocate guessing opportunities) and observed the effects of our two experimentally manipulated independent variables on teams' hierarchical differentiation. Supporting our hypotheses, we found that teams experiencing success (vs. failure) distributed opportunities more hierarchically, and this effect was stronger among teams with a higher (vs. lower) pre-existing hierarchy. Additional analysis indicated that members with greater influence over their teams' outcomes (i.e., those members who were assigned more opportunities in the first round) were assigned higher levels of influence for the subsequent round following success (compared to failure).

Nonetheless, the experimental context of Study 1 contains some limitations which may not generalize to other teams. For example, the task was relatively simple, the teams' lifespans were short, and members did not have knowledge of each other's abilities on the task. In addition, the experiment created artificially extreme conditions of hierarchy, where the average team in the high pre-existing hierarchy condition experienced a small decrease from their initially assigned hierarchy, presumably because their pre-existing hierarchy was already very steep. Although we still find patterns consistent with our predictions – successful (vs. failing) teams reported a higher degree of hierarchy, consistent with the idea that succeeding teams grant more influence to what was seen as the cause of success – the design of Study 1 may limit its generalization to real-world teams.

In Study 2, we sought to increase external validity across task and team domains by using archival data from the NBA. Scholars often use the NBA and other professional team sports to test theories, particularly those concerning hierarchies and teams (Chen and Garg 2018, Halevy et al. 2012, Zhang 2019). Whereas Study 1 focused on what Hollenbeck et al. (2012) describe as "experimental teams," NBA teams more closely resemble "long-term project teams," such as professional service or consulting teams. In these teams, members work together to achieve relatively stable goals across several performance cycles. In fact, NBA teams share many characteristics with teams commonly found in organizations (Day et al. 2012), as they do not disband at the end of one performance cycle (i.e., a game) and instead work together on complex and interdependent tasks across performance cycles (Halevy et al.

2012, Ronay et al. 2012). In addition, unlike organizational contexts where measuring performance involves a significant degree of subjectivity, team performance in the NBA is objective (i.e., games won) and visible to all members. Therefore, the NBA provides a useful context to examine our hypotheses with ongoing teams that resemble those commonly found in organizations.

Study 2: Method

Data and Operationalizations

In the basketball context, having control over the ball is an important marker of influence because it is a scarce resource that helps determine a team's ability to win (Halevy et al. 2012). There are two major decisions related to possession of the ball, namely which member of the team gets to shoot the ball and how the ball is passed before a shot occurs. We thus created two datasets to assess hierarchy: field goal attempts (i.e., who shoots the ball) and team passing networks (i.e. who passes the ball to whom). All data were collected from the official NBA website (NBA.com). The first dataset (field-goal attempts) was collected from 34 seasons between 1985–86 and 2018–19; the second dataset (passing networks) was collected for five seasons between 2014–15 and 2018–19. Starting dates were chosen based on availability, and end dates were chosen based on the most recently completed season. For all measures, we calculated a team's average hierarchy score over a 10-game rolling window ($N_{\text{Field Goal Data}}$ = 66,047; $N_{\text{Network Data}}$ = 8,152; missing games removed). We later report identical effects with windows of 5 and 15.

Hierarchy. Our first dataset used field goal attempts. We focus on hierarchy in field-goal attempts rather than other metrics such as minutes played or salary (e.g., Halevy et al. 2012) because field-goal attempts (i.e., shooting the ball) are necessary for a team to win and thus more directly reflect members' influence over team outcomes; in contrast, a player could spend time on the court without necessarily contributing points. We used the standard deviation (SD), coefficient of variation (CV), and Gini coefficient (GC) of field goal attempts to operationalize hierarchy. These three metrics have been commonly used in prior research (Greer et al., 2018), where a high SD, CV, or GC value represents greater hierarchical differentiation (i.e., some players take more shots than others), and a low value indicates lower hierarchical differentiation (i.e., shots are distributed more equally).

Our second dataset assessed hierarchy via a team's passing network. In 2014–15, the NBA began using motion cameras to track detailed game-level information, including how many times players passed the ball to each of their teammates. This provided an opportunity to assess hierarchy from a more nuanced perspective – in addition to assessing hierarchical differentiation in terms of differentiation of influence over team outcomes (i.e., shots taken), we can directly capture hierarchical differentiation in terms of the process by which this influence is allocated (i.e., ball movement). Thus, consistent with the "unobtrusive, high-frequency, data dense, and near continuous measurement" approaches advocated by scholars in the team dynamics literature (Kozlowski 2015), we constructed more process-oriented metrics of hierarchical differentiation via granular behaviors.

We operationalized hierarchy based on a team's passing network in two ways: the team's out-degree centralization (Freeman 1979), and the team's acyclicity index (Everett and Krackhardt 2012, Krackhardt 1994). The team's out-degree centralization, computed using Freeman's (1979) centralization index,[3] captures hierarchy in terms concentration, or the degree to which the majority of passes are sent by one player. A high out-degree centralization indicates that the ball tends to be passed from one player, whereas a low out-degree centralization indicates that passes are sent more equally. Where centralization is concerned with the extent to which one member wields most of the influence, a team's acyclicity index considers all possible dyads within a team network and examines the proportions of ties that are unreciprocated. Specifically, it accounts for the fact that network ties inherently have directional properties (e.g., A passing to B is different from B passing to A) and captures the extent to which ties in a team are asymmetrical (e.g., A passes to B, but B does not pass to A). A high acyclicity index indicates that players tend to receive passes from others (but do not pass back), whereas a low acyclicity index indicates that players tend to return passes that they receive. Relative to the measure of inequality of field goal attempts, the acyclicity index creates an aggregate measure of inequality based on all possible dyadic relationships in the team, hence providing a more in-depth metric indicating the team's coordination

[3] Using in-degree centralization produces identical support for our hypotheses.

processes. Thus, acyclicity is consistent with a considerable body of psychological and ethological studies on hierarchy (Magee and Galinsky 2008, Zitek and Tiedens 2012) as it more closely captures hierarchy from the perspective of *how* team members work with one another and coordinate work processes rather than *what* level of inequality exists between members (Bunderson et al. 2016).

Past performance. We operationalized team past performance by counting the number of games won during the previous 10 games (Zhang 2018). As with the calculation of our hierarchy measures, we show similar effects with rolling windows of 5 and 15 games.

Controls. In both datasets, we controlled for variables related to team member turnover. This is important because changes in terms of which members play may occur based on factors that are unrelated to performance (e.g., injuries, suspensions, or rotating backup players). Thus, we counted the number of changes to players who saw playing time between two consecutive games (i.e., if a player played in t-1 but not t0, this was counted as a change). This number was then averaged across the past 5, 10, or 15 games, thus capturing the number of *changes to a team's lineup*. We also controlled for the *average number of field goals shot* by the players on the team during the past 5, 10, and 15 games to account for the fact that some teams take more shots, on average, than others. We also controlled for the *opponent's winning percentage* entering a game to address concerns that teams may organize themselves more or less hierarchically based on an opponent's skill level. Finally, we also controlled for whether a team was *home* (*vs. away*) during a game. For the passing network dataset, we followed Bunderson et al. (2016) and controlled for several variables related to a team's network, including its *efficiency*, which describes how efficiently the network can exchange resources, and *reachable connectedness*, which captures the extent to which at least one member can (directly or indirectly) influence all other members.[4]

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[4] Efficiency was computed following Krackhardt (1994) via the formula 1-[W /max(W)], where W is the number of network ties in excess of the minimum needed for a hierarchical tree and max(W) is the maximum number of excess ties. Efficiency and acyclicity should be positively correlated because inefficient networks are likely to include cycles. Reachable connectedness was computed as 1 - [(V-1)/(*n*-1)], where V is the smallest number of actors needed such that all actors in the network are reachable from this set of actors and *n* is the total number of actors (Everett and Krackhardt 2012). We also controlled for a team's network *density*, which captures the proportion of actual ties among the total possible number of ties (Wasserman and Faust 1994). However, density was highly correlated with efficiency (VIF > 10); therefore, we used only density or efficiency and following Bunderson et al. (2016), reporting our results with efficiency but note that results are replicated using density.

Our main models are linear panel models with team fixed effects. The team fixed effects help account for time-invariant factors associated with potential differences among teams. We also clustered standard errors at the team level. Using random effects produces similar results.

Study 2: Results

Tables 3 and 4 display descriptive statistics and correlations. Our five measures of hierarchy across the past 10 games are moderately to highly correlated (r = .24 to .88; Table C12), suggesting similarity between our measures. Table 5 displays the results of our regression analyses. All VIFs (excluding interaction terms) were under 2.0, well below the suggested 10.0 threshold, suggesting little issue regarding collinearity. Below, we interpret the results associated with a 10-game rolling window.

We first examined the descriptive differences between winning and losing teams. We do so by creating a median split based on performance, and comparing the change (i.e., difference score) in average hierarchy over the past ten games compared to the current game – controlling for average hierarchy, winning teams had an increase in hierarchy (M_{SD} = 0.022; M_{CV} = 0.003; M_{GC} = 0.005; $M_{acyclicity}$ = 0.001; $M_{Centralization}$ = 0.001) and losing teams had a decrease in hierarchy (M_{SD} = -0.033; M_{CV} = -0.008; M_{GC} = -0.003; $M_{acyclicity}$ = -0.001; $M_{Centralization}$ = -0.003). This is suggestive that teams with past performance success (failure) are increasing (decreasing) in hierarchy.

We then used regressions to formally test H1. As seen in Table 5, past performance was positively associated with a higher degree of hierarchy when hierarchy was measured through field-goal SD (Model 1: b = 0.156, p < .001), CV (Model 3: b = 0.032, p < .001), GC (Model 5: b = 0.012, p < .001), and passing network acyclicity (Model 7: b = 0.003, p = .008). There was no effect when hierarchy was measured through centralization (Model 9: b = -0.000, p = .503). Overall, four out of our five measures indicate that, within a given team (i.e., following team fixed effects), past performance was positively associated with a higher degree of hierarchy. We next tested H2, which stated that the relationship between past performance and hierarchy is stronger (weaker) among teams with a pre-existing higher (lower) degree of hierarchy. As seen in Table 5, there was a significant interaction when hierarchy was measured through field-goal SD (Model 2: b = 0.066, p = .024; Figure 2a), CV (Model 4: b

= .213, p < .001; Figure 2b), GC (Model 6: b = .092, p = .002; Figure 2c), and passing network acyclicity (Model 8: b = 0.043, p = .004; Figure 2d). The interaction was not significant when hierarchy was measured through centralization (Model 10: b = -0.002, p = .897).

Simple slopes indicate that among teams with a high pre-existing degree of hierarchy (+1 *SD*), past performance success was positively associated with a higher degree of hierarchy (SD: b = 0.212, p < .001; CV: b = 0.053, p < .001; GC: b = 0.017, p < .001; acyclicity: b = 0.002, p < .001). Among less hierarchical teams (−1 *SD*), there was either a weaker, but still positive, association (SD: b = 0.105, p = .002; CV: b = 0.012, p = .008; GC: b = 0.008, p < .001) or no association between past performance and hierarchy (acyclicity: b = 0.000, p = .779). Overall, the results support H2 across multiple hierarchy metrics – the relationship between prior performance and a team's hierarchical differentiation is stronger (weaker) among teams with a higher (lower) pre-existing degree of hierarchy.

Robustness Checks

We conducted several robustness checks. For parsimony, we only report the removal of non-essential players in the main text. We refer readers to the Appendix, where we report robustness checks for different rolling windows, results without controls, the removal of potential outliers, and the utilization of passing ratios. Finally, although controlling for baseline levels of an outcome represents one way to assess change (e.g., Cohen et al. 2013), we also calculated difference scores as a measure of change (e.g., Alison 1990), thus providing a potential way to assess absolute changes in hierarchy.

When NBA teams are significantly ahead during a game, they may include reserve players who play for only a few minutes. As a result, winning teams could have players with fewer field-goal attempts or passes (because certain players played less), which could result in a higher degree of hierarchy. Although we already controlled for the number of roster changes in a team's hierarchy, we decided to conduct another analysis after dropping players who did not play for more than 7.5 minutes in a game. Results are similar after dropping players who did not play for more than 5 or 10 minutes.

Using a lag of 10 games (Table C4), there was a significant positive relationship between past performance and current hierarchy when hierarchy was measured through field-goal SD (Model 1: b =

0.134, $p < .001$), CV (Model 3: $b = 0.021$, $p < .001$), GC (Model 5: $b = 0.008$, $p < .001$), and passing network acyclicity (Model 7: $b = 0.001$, $p = .002$); there was no relationship when hierarchy was measured through centralization (Model 9: $b = -0.000$, $p = .878$). We also found a significant interaction between past performance and pre-existing hierarchy when hierarchy was measured through SD (Model 2: $b = 0.110$, $p < .001$), CV (Model 4: $b = 0.282$, $p < .001$), GC (Model 6: $b = 0.174$, $p < .001$), and passing network acyclicity index (Model 8: $b = 0.038$, $p = .009$); there was no relationship when hierarchy was measured using centralization (Model 10: $b = -0.000$, $p = .957$). Simple slopes were identical in significance and direction as in our main analysis. Thus, our results are replicated when non-important players are dropped. We refer readers to Table C5 for similar effects using rolling windows of 5 and 15 games, as well as other robustness checks.

Study 2: Discussion

Study 2 was an archival study of the NBA utilizing multiple operationalizations of hierarchy, both conventional (i.e., field-goal attempt inequality) and more fine-grained (i.e., passing network pattern). The findings of this study provide support for our hypotheses based on real-world teams that share many team characteristics common in organizations (Day et al. 2012, Halevy et al. 2012, Ronay et al. 2012) and generalizability across a different type of task and team (relative to Study 1). We operationalized hierarchy using five metrics, and our effects emerged for four of the five metrics.

We speculate that one potential reason why we did not find support for our hypotheses via passing centralization is in part due to the differences between what centralization and acyclicity represent in the context of NBA passing. Centralization focuses on concentration in terms of passes sent (a team is highly centralized when the ball is mostly passed from one player), whereas acyclicity focuses on dyadic asymmetries (whether more passes were sent than received). When the directional nature between dyads can be considered, it may offer richer insights than inequality in passes alone. Indeed, as discussed by Bunderson et al. (2016), measuring asymmetries in dyadic relations and then aggregating upwards to assess a team’s overall hierarchy should produce better representations of hierarchy, as such measures account for asymmetries in dyadic relationships. Empirically, centralization and acyclicity are only weakly correlated at t_0 (.22 in Bunderson et al. 2016, and .15 in our data), which suggests they may represent different variants of hierarchy. Particularly, while centralization may crudely describe concentration of influence, acyclicity captures the degree to which influence forms a cascading "chain of command." Hence, compared to centralization, in our context, acyclicity may allow us to "get closer to the hierarchies that ultimately shape group actions" (Bunderson et al. 2016, p. 1268).

General Discussion

We developed and tested hypotheses concerning how past performance affects a teams' current hierarchical differentiation. Whereas existing work highlights hierarchical differentiation as an input to performance (Greer et al. 2018), we highlight how hierarchical differentiation is also an output of performance. In doing so, we begin answering a call to better understand the dynamics of hierarchy (Bendersky and Pai 2018). Experimental (Preliminary Study and Study 1) and observational (Study 2) evidence provided converging support for our hypotheses. In Study 1, teams experiencing success (vs. failure) tended to distribute resources more hierarchically, and this effect was stronger for teams with a higher (vs. lower) pre-existing degree of hierarchy. In Study 2, we found similar effects in real-world teams engaging in a high-stakes, more interdependent, and more complex task (i.e., NBA teams).

Theoretical Contributions

Hierarchy has been conceptualized predominantly from a static perspective (Anderson and Brown 2010, Halevy et al. 2011), resulting in frequent calls for greater attention toward its dynamics (Bendersky and Pai 2018, Tarakci et al. 2015). We help respond to these calls for a greater understanding of hierarchy dynamics and, in doing so, contribute to the literature in several ways.

First, we shift the theoretical focus from viewing performance mostly as an outcome of hierarchies to a more dynamic perspective on performance and hierarchies. Existing models tend to conceptualize performance as an output to hierarchies (Greer et al. 2018), thus overlooking the fact that performance is dynamic as teams interact over multiple performance cycles (Cronin et al. 2011, Kozlowski and Bell 2013, Marks et al. 2001). We offer an alternative to existing models, by highlighting how performance is not only the final output of a team's hierarchy but is also a key determinant. Within teams research, similar calls have been made to explore the bi-directional relationship between team processes and their outcomes (Cronin et al. 2011, Kozlowski 2015). For example, work has examined how team efficacy (Lindsley et al. 1995) or cohesion (Mathieu et al. 2015) both antecedents and consequences of team performance, thus creating “positive performance spirals.” Our work begins to highlight how hierarchical differentiation is a team process that may vary based on earlier performance cycles and serve as an input in later performance cycles. Combined with meta-analytical evidence suggesting that hierarchy harms performance (Greer et al. 2018), our work suggests that hierarchies can *prevent* the emergence of “positive performance spirals”—after experiencing success, teams become more hierarchical, which can harm their future performance. Thus, our research seems to provide a caveat to past work suggesting that success begets future success (Lindsley et al. 1995, Mathieu et al. 2015).

Relatedly, taken to its logical extreme, previous theory on the self-reinforcing nature of hierarchies would suggest that all hierarchies ultimately end in a “winner-takes-all” scenario in which one person monopolizes almost all the influence in the team (Magee and Galinsky 2008). However, hierarchies in the real world rarely exhibit this extreme pattern. Our work suggests that one potential reason for this is that consistent success, which may help justify extreme differentiation in influence, may not be sustainable. In this way, our findings also dovetails with the work of Gibson (p. 140), who suggested that high-efficacy groups “set out on a path that they believe will lead to effective performance, but…their chance of actually achieving effective performance is low.” Future work could better ascertain whether hierarchy can potentially hinder the emergence of positive team performance spirals.

Second, prior work has largely developed a consensus that hierarchy tends to be self-reinforcing (Magee and Galinsky 2008). For example, prior work offers a fairly static perspective on hierarchical differentiation whereby success simply reifies a group’s hierarchy (Berger et al. 1998; e.g., “if it isn’t broken, don’t fix it”). Our results, particularly those presented in Study 2, seem to challenge this view, as it seems that a team’s hierarchical differentiation is exacerbated or reduced by recent performance. Thus, at least within the context of hierarchies based on influence, our work offers an alternative to this static perspective: Teams dynamically adjust their members’ influence, and therefore the extent of their hierarchical differentiation, based on the team's recent performance. Hence, our work helps to challenge one perspective on static hierarchies: Rather than groups simply reifying their existing hierarchical differentiation following success (thus suggesting a static perspective), teams may vary their degree of differentiation following performance outcomes (suggesting a more dynamic perspective).

Third, we offer a team-level perspective to existing work on hierarchy dynamics which as primarily focused on individual-level changes – for example, when individuals may change rank (Bendersky and Shah 2012, Bunderson 2003), the outcomes of changing rank (Marr and Thau 2014, Neeley and Dumas 2016), how individuals react to potential changes in rank (e.g., Maner and Mead 2010, Pettit et al. 2016), and when rankings are more or less stable (Berger et al. 1998, Chizhik et al. 2003, Walker et al. 1986). The current literature's focus on individual rank change seems to neglect broader dynamics regarding the structure of the hierarchy itself. We offer an alternative: The structure and differentiation within the hierarchy itself may vary, and it may do so following team success or failure.

Our work also has practical implications for the management of teams following success. A high degree of hierarchy is associated with several potential downsides, including decreased performance and increased conflict (Greer et al. 2018). Given these detrimental effects of hierarchy, our work suggests that practitioners may benefit from managing attributions for a team's success to decelerate hierarchy formation. In a manner similar to the hot-hand effect (Gilovich et al. 1985), collectives may tend to intuitively attribute their performance success to individuals within the team (Weber et al. 2001) rather than more complex processes such as coordination patterns or teamwork. To better manage attributions for success, research on after-event reviews (AERs, or debriefings; Ellis et al. 2006) may prove relevant. Teams that undergo AERs tend to develop richer mental models of how components of teamwork impact performance outcomes (Smith-Jentsch et al. 2008) and develop more specific (versus general) attributions for their performance (Ellis et al. 2006). In particular, teams that experience success may benefit from AERs by developing more nuanced mental models of why their team succeeded, thus fostering greater cohesion and efficacy (Villado and Arthur 2013), factors which are more likely to support the emergence of positive performance cycles (Mathieu et al. 2015). Thus, contrasting with common intuitions regarding the importance of emphasizing past success to increase performance (Mathieu et al. 2015), our work suggests a more nuanced perspective: Given the established negative consequences of hierarchy, practitioners should be mindful of both how success may facilitate the formation of hierarchical differentiation and the potential downsides thereof for team outcomes.

Limitations and Future Research Directions

Despite using different contexts and samples, there are potential limits to the generalizability of experimental and observational sports data. We note at least two potential boundary conditions that arise from our empirics. The first potential boundary condition deals with the generalizability of our theory when shifting from considering teams (i.e., typically 3–15 members) to larger collectives (e.g., 100-member firms). In larger collectives, changes in influence may be more difficult to implement because larger collectives cannot easily implement change without investing significant efforts in communication and coordination. Thus, the effects identified in this study may be weaker in larger (vs. smaller) collectives. The second potential boundary condition is that teams in our empirical settings are held constant in size. In some contexts (e.g., start-ups), success can lead to growth, which may require greater hierarchical differentiation to manage the coordination demands of the expanding entity. Although this alternative does not rule out (and is in fact consistent with) our overall findings, it does suggest another process through which success may increase hierarchical differentiation in collectives that are not fixed in size. Our study does not allow for such an investigation, and thus future work could examine the dynamic interplay between success, collectives' size, and hierarchical structures.

When studying teams, it is helpful to consider the characteristics of teams and the tasks they perform (Hollenbeck et al. 2012). We focused on teams that were temporally stable (i.e., teams were expected to work together in the future) and working towards achieving interdependent goals. These characteristics may represent boundary conditions for our findings – for example, perhaps teams subject to temporal instability may not respond to performance successes and failures because their members do not expect to work together in the future. Furthermore, our tasks differed in Studies 1 and 2. We observed similar effects across studies, which seems to suggest the identified effects are not bounded by differences in task and team characteristics between Studies 1 and 2. Nonetheless, team and task features may serve as additional boundary conditions and an area for future research.

Third, future work could explore the potential of "reshuffling," whereby influential members are replaced following failure. That is, failure causes teams to move individuals around in a hierarchy, leaving the differentiation level of the hierarchy constant. We suspect there are two conditions that may facilitate reshuffling, which also inform potential boundary conditions: First, we focused on teams with little distinctions in formal hierarchy. Teams with differences in formal power or rank (e.g., "CEO" or "team leader") may come with a relatively immutable set of influences and responsibilities, making members influence less likely to be changed. In these contexts, reshuffling may be more likely, as significantly diminishing the influence of a formally designated manager from the hierarchy may be unusual. Second, replacement of influential members could hinge on teams' knowledge of members' underlying skills and ability to further team success. For example, as members interact for longer periods of time, teams may become more familiar with each members' skills and will simply replace a struggling member with a more competent member; therefore, teams may be less likely to change their hierarchical differentiation later in their lifespan as compared to earlier (Gersick and Hackman, 1990). Moreover, replacing a high-influence member also depends on whether a suitable candidate is available. If such a candidate is not yet available, it may take time for teams to identify which member is equally competent. Hence, we speculate that teams that have a relatively longer history may engage in more reshuffling following failure, and may experience greater inertia, compared to younger teams. Thus, future work could adopt a longer-term perspective and observe the process by which failure leads to the rise of new influential members and whether such selection depends on the attributional processes we discussed.

Fourth, we do not distinguish between different types of success and failure. However, success on important projects may increase the credit given to influential individuals. In our NBA context, we used rolling window averages to capture performance outcomes, which may obscure nuanced differences among those games. For example, we build on the notion that performance outcomes tend to be attributed to factors internal to a team (Weber et al. 2001). Consistent events (e.g., winning streaks) are more likely to be attributed to internal factors than inconsistent events (e.g., one-off wins; Kelley and Michela 1980). Thus, streaks of consistent winning may be more likely to result in an increase in degree of hierarchy than non-streaks. In addition, expected (vs. unexpected) failures may decrease the likelihood of teams seeking an explanation for their performance (Bohner et al. 1988). When performance outcomes are expected, it is possible that success or failure may not influence a team's hierarchy. Distinguishing between these different types of success/failure remains a fruitful area for future work.

Finally, an intriguing area of future research would be to distinguish between when individuals are granted versus claim influence. For example, future work could make a distinction as to when influence is obtained via coercive conflict-based dominance (e.g., claiming influence) versus deferred competence-based prestige (e.g., being granted influence; Cheng 2020, Kakkar et al. 2020, Maner 2017). Under circumstances where dominance strategies are more likely – such as when teams include individuals high in narcissism, hubristic pride, and disagreeableness (Maner 2017) – we may expect that individuals will claim more influence following success. In contrast, under circumstances where prestige strategies are more likely – such as when teams contain individuals are high in agreeableness, social monitoring, and fear of negative evaluation (Maner 2017) – we could expect that influence changes via freely conferred deference. Future research should examine other contexts that determine when influence is obtained via dominance (claiming influence) or prestige (being granted influence).

Conclusion

We respond to recent calls for more dynamic views on hierarchies (Bendersky and Pai 2018, Tarakci et al. 2015). In doing so, we extend existing hierarchy-performance models: Hierarchies are not only a key determinant of performance but are also actively shaped and molded by it. When combined with recent meta-analyses indicating how hierarchical differentiation can harm team performance (Greer et al. 2018), this finding seems to suggest a paradox of success whereby success may increase hierarchical differentiation, which in turn harms future performance. As teams experience success, managers may want to be wary of how responsibility for success and subsequent influence is allocated – crediting success to specific individuals may harm a team's ability to be sustainably successful.

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Table 1
Study 1: Descriptive statistics

Variable	*M*	*SD*	1	2	3
1. Pre-existing hierarchy manipulation[a]	0.50	0.50			
2. Past performance manipulation[b]	0.50	0.50	-.00		
3. Hierarchy choice for second round	0.85	0.55	.15*	.25**	
4. Guesses allocated to the most influential member for second round	3.41	1.01	.33**	.14*	.28**

Note. *N* = 245 teams; [a] Dummy coded: 0 = Low, 1 = High; Dummy coded: 0 = Failure, 1 = Success.
* $p < .05$, ** $p < .01$.

Table 2
Study 1: Means for dependent variables by experimental condition

Condition	Hierarchy choice for second round	Guesses allocated to most influential member for second round
High pre-existing hierarchy / Failure	0.81[a]	3.05 [a]
	(0.50)	(0.91)
High pre-existing hierarchy / Success	1.18	4.07
	(0.81)	(1.35)
Low pre-existing hierarchy / Failure	0.74 [a, b]	3.10 [a, b]
	(0.27)	(0.70)
Low pre-existing hierarchy / Success	0.69 [a, b]	3.43 [b]
	(0.29)	(0.59)

Note. $N_{\text{High Hierarchy / Performance Failure}} = 62$; $N_{\text{High Hierarchy / Performance Success}} = 61$; $N_{\text{Low Hierarchy / Performance Failure}} = 61$; $N_{\text{Low Hierarchy / Performance Failure}} = 61$; Standard deviations are in parentheses. Within the same column, means with a different superscript letter are significantly different ($p < .05$). For instance, in the second column, 4.07 and 3.05 do not share a superscript letter, indicating their difference was statistically significant. In contrast, 3.05 and 3.10 share the superscript letter *a*, hence indicating that their difference was not significant.

Table 3

Study 2: Descriptive Statistics (Field-Goal Attempts Data)

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
1. Home (0 = Away, 1 = Home)	0.50	0.50										
2. Player changes (t10)	1.83	0.60	.00									
3. FGA mean (t10)	8.23	0.67	.00	-.03**								
4. Opponent winning percentage	0.50	0.19	-.01**	.00	.00							
5. Pre-existing hierarchy (FGA SD; t10)	5.88	0.82	.00	-.02**	.33**	-.01						
6. Pre-existing hierarchy (FGA CV; t10)	0.84	0.10	.00	.01**	-.33**	-.01	.68**					
7. Pre-existing hierarchy (FGA Gini; t10)	0.37	0.05	.00	.02**	-.26**	-.01*	.81**	.88**				
8. Current hierarchy (FGA SD; t0)	5.85	1.42	.00	-.02**	.13**	.04**	.43**	.30**	.36**			
9. Current hierarchy (FGA CV; t0)	0.84	0.19	.01**	-.01	-.12**	.02**	.25**	.32**	.32**	.58**		
10. Current hierarchy (FGA Gini; t0)	0.37	0.08	.01*	.00	-.10**	.02**	.35**	.37**	.42**	.76**	.77**	
11. Past performance (t10)	0.50	0.21	.01**	-.04**	-.09**	-.01*	.09**	.11**	.14**	.06**	.07**	.09**

Notes. *N* = 66,047 games; ** $p < 0.01$, * $p < 0.05$

Table 4

Study 2: Descriptive Statistics (Network Data)

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
1. Home (0 = Away, 1 = Home)	0.50	0.50										
2. Player changes (t10)	0.96	0.37	.00									
3. FGA mean (t10)	8.24	0.60	-.01	-.07**								
4. Passing network: Connectedness (t10)	1.00	0.00	-.01	-.01	.02*							
5. Passing network: Efficiency (t10)	0.39	0.06	-.00	-.10**	-.49**	-.02						
6. Opponent winning percentage	0.50	0.18	-.01	-.00	.01	-.01	-.01					
7. Pre-existing hierarchy (Acyclicity; t10)	0.16	0.02	-.00	-.01	.02*	.00	.23**	.01				
8. Pre-existing hierarchy (Centralization; t10)	0.28	0.04	-.00	.02	-.18**	-.01	.61**	-.00	.19**			
9. Current hierarchy (Acyclicity; t0)	0.16	0.05	.02	-.01	.02	.01	.07**	-.00	.17**	.07**		
10. Current hierarchy (Centralization; t0)	0.28	0.08	.00	-.03*	-.04**	.00	.21**	-.01	.09**	.31**	.03**	
11. Past performance (t10)	5.00	2.07	.00	-.09**	-.10**	.04**	.16**	-.03*	.02	.09**	.03**	.07**

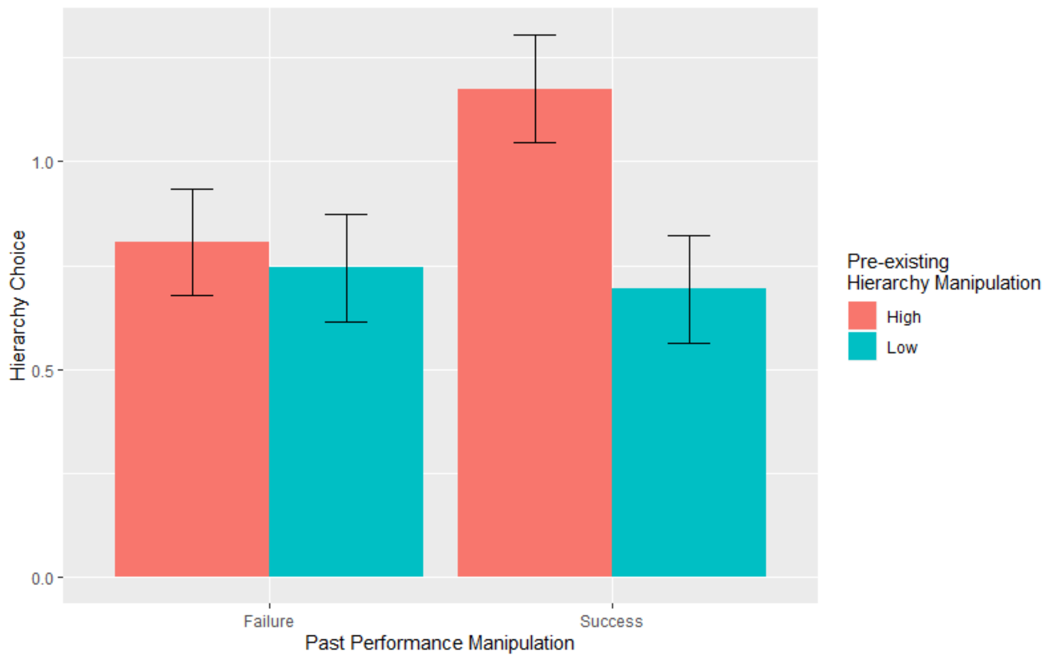
Notes. *N* = 8,152 games; ** $p < 0.01$, * $p < 0.05$

Table 5
Study 2: Regression Results

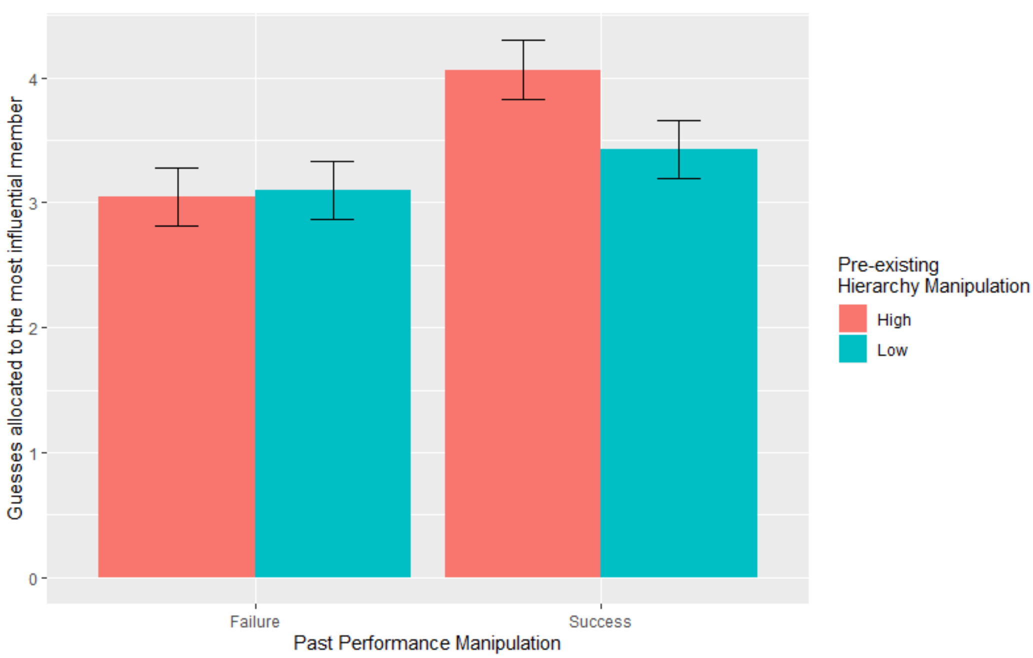
	Current hierarchy (SD)		Current hierarchy (CV)		Current hierarchy (Gini)		Current hierarchy (Acyclicity)		Current hierarchy (Centralization)	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
(Intercept)	**2.04*****	**2.22*****	**0.35*****	**0.44*****	**0.07*****	**0.09*****	0.17	0.20	0.04	0.04
	(0.10)	(0.13)	(0.02)	(0.02)	(0.01)	(0.01)	(0.17)	(0.17)	(0.24)	(0.24)
Home (1 = Home; 0 = Away)	-0.01	-0.01	**-0.00****	**-0.00****	**-0.00***	**-0.00***	**-0.00**	**-0.00**	-0.00	-0.00
	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Opponent winning percentage (t1)	**0.38*****	**0.38*****	**0.03*****	**0.03*****	**0.01*****	**0.01*****	-0.00	-0.00	0.00	0.00
	(0.03)	(0.03)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
Player changes (t10)	-0.00	-0.00	-0.00	-0.00	0.00	0.00	-0.00	-0.00	**-0.02****	**-0.02****
	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
FGA mean (t10)	**-0.07*****	**-0.07*****	**-0.00****	**-0.00****	**0.00*****	**0.00*****	0.00	0.00	-0.00	-0.00
	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number of wins (t10)	**0.16*****	-0.23	**0.03*****	**-0.15*****	**0.01*****	**-0.02**	**0.00****	**-0.01***	-0.00	0.00
	(0.02)	(0.17)	(0.00)	(0.03)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
Pre-existing hierarchy (SD; t10)	**0.72*****	**0.69*****								
	(0.01)	(0.02)								
Pre-existing hierarchy (SD; t10) x Past performance (t10)		**0.07***								
		(0.03)								
Pre-existing hierarchy (CV; t10)			**0.58*****	**0.47*****						
			(0.01)	(0.02)						
Pre-existing hierarchy (CV; t10) x Past performance (t10)				**0.21*****						
				(0.04)						
Pre-existing hierarchy (Gini; t10)					**0.71*****	**0.67*****				
					(0.01)	(0.02)				
Pre-existing hierarchy (Gini; t10) x Past performance (t10)						**0.09****				
						(0.03)				
Passing network connectedness (t10)							-0.02	-0.03	0.20	0.20
							(0.17)	(0.17)	(0.24)	(0.24)
Passing network efficiency (t10)							0.03	**0.04**	0.02	0.02
							(0.02)	(0.02)	(0.03)	(0.03)
Pre-existing hierarchy (Acyclicity; 10)							0.00	**-0.22****		
							(0.03)	(0.09)		
Pre-existing hierarchy (Acyclicity; t10) x Past performance (t10)								**0.04****		
								(0.01)		
Pre-existing hierarchy (Centralization; t10)									**0.08***	0.09
									(0.04)	(0.07)
Pre-existing hierarchy (Centralization; t10) x Past performance (t10)										-0.00
										(0.01)
Adj. R^2	0.20	0.20	0.11	0.11	0.18	0.18	0.05	0.06	0.13	0.13
RMSE	1.28	1.28	0.18	0.18	0.07	0.07	0.05	0.05	0.07	0.07

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Figure 1. *Hierarchy distributions, as a function of past performance and hierarchy (Study 1).*



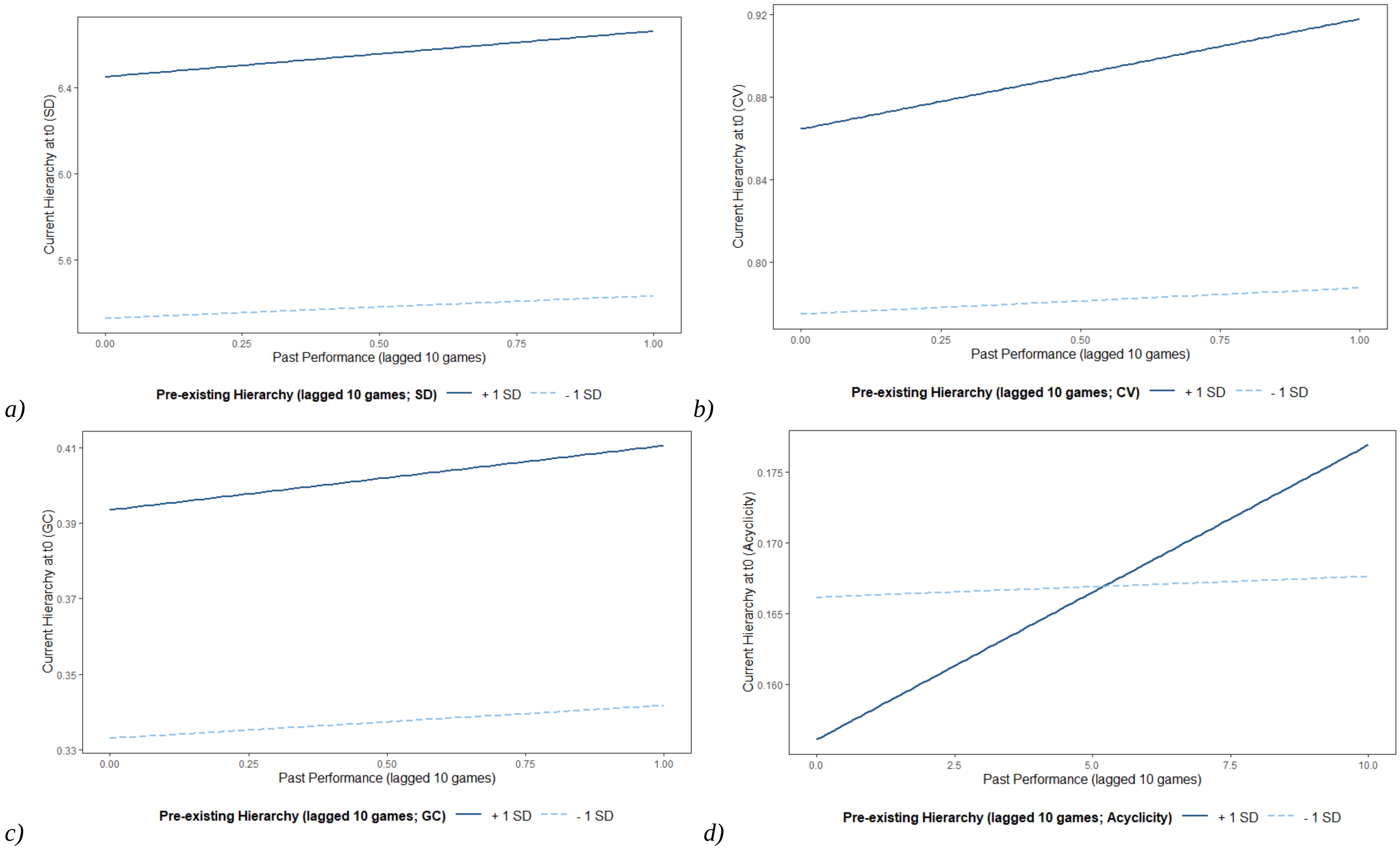
a)



b)

Note.
a = Team hierarchy (measured through standard deviation in guesses) based on pre-existing hierarchy and past performance; b = Number of guesses held by the person with the most guesses in round 1

Figure 2. *Study 2: The relationship between past performance and current team hierarchy is moderated by pre-existing hierarchy*



Note. a = Pre-existing and current hierarchy as measured through standard deviation (SD) in field-goal attempts; b = Pre-existing and current hierarchy as measured through coefficient of variation (CV) in field-goal attempts; c = Pre-existing and current hierarchy as measured through Gin coefficient (GC) in field-goal attempts; d = Pre-existing and current hierarchy as measured through acyclicity in passing network.