BEYOND THE PYRAMID: ALTERNATIVE FORMAL HIERCHICAL STRUCTURES AND TEAM PERFORMANCE

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ABSTRACT

Formal hierarchical differentiation is a cornerstone of the organizing process. Prior research has focused primarily on pyramid-shaped formal hierarchies, despite documented limitations of the pyramid structure. We adopt a multi-method approach to consider the utility of alternative hierarchical shapes. First, we identify six “pure type” formal hierarchies that teams might employ. Next, we develop three propositions explaining the effects of hierarchy on team members’ cognition and behavior. We use the propositions to parameterize an agent-based computational model in which formal hierarchical differentiation influences team performance by creating power imbalances that affect team members’ perspective taking motivation, and by influencing members’ social identification with the team. The modeling results reveal how the effects of the six hierarchies are contingent upon task characteristics that influence team members’ perspective taking accuracy (e.g., task variety), and enable us to craft an expanded, team-level theory of the association between formal hierarchical differentiation and team performance. A field study of 68 clinical nursing shifts in 5 mid-sized hospitals supports a key theoretical prediction. Specifically, we find that a negatively skewed (inverse pyramid-shaped) formal hierarchy enhances team performance relatively to a positively skewed (pyramid-shaped) hierarchy when task variety is high, but not when task variety is low.

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Formal hierarchical differentiation, which occurs when certain members of a team or organization are appointed to formal leadership or supervisory positions, has important implications for collective performance (Blau, 1970; Greer, de Jong, Schouten, & Dannals, 2018; Magee & Galinsky, 2008). In many teams, formal hierarchy takes on a pyramid shape, such that a few members are granted formal authority over all other members (Anderson & Brown, 2010; Bunderson, van der Vegt, Cantimur, & Rink, 2016; Greer, Van Bunderen, & Yu, 2017). Scholars have tended to assume that pyramid-shaped formal hierarchies are so prevalent because they offer collectives numerous benefits, including a clear line of command (Greer & Van Kleef, 2010) and an incentive for members to perform well (Magee & Galinsky, 2008). However, recent work has called the functionality of pyramid-shaped authority structures into question (Anderson & Brown, 2010; Bunderson & Reagans, 2011; Greer et al., 2018). In particular, studies have found that such hierarchies can reduce teams' adaptability and innovation by preventing them from incorporating the insights of lower-level members (Manz & Sims, 1987; Pearce, 2004), or by increasing conflict and dissent (Greer et al., 2017; 2018). These drawbacks are particularly relevant to teams in today's organizations, which must operate in the sort of uncertain and ambiguous environments in which collaborative decision-making is thought to be most important (Uhl-Bien, Marion, & McKelvey, 2007).

Despite the mixed findings concerning the effectiveness of the traditional, pyramid-shaped approach to formal hierarchical differentiation, scholars have been slow to consider alternatives. The primary option that has been suggested is the "leaderless," or "self-managing" team, in which no formal differentiation exists (e.g., Carson, Tesluk, & Marrone, 2007; Manz & Sims, 1987). Thus, existing research has focused on comparing teams with a pyramid structure to teams with no formal hierarchy at all, or on the consequences of pyramid "steepness" or centralization. This approach is typically reflected in an operationalization of hierarchy as the number of levels of formal authority a team contains, or the extent to which authority is concentrated in a single individual (Anderson & Brown, 2010; Greer et al., 2017). However, such operationalizations obscure the fact that a pyramid is not the only way that formal authority within teams might be structured (Yu, Greer, Halevy, & van Bunderen, 2019).

In this article, we adopt a multi-method approach to consider new ways of seeing formal hierarchy. First, we identify six fundamentally different "pure type" formal hierarchical structures that teams might employ and provide real-world examples of each. Four of these structures have received little scholarly attention and thus it is not possible to develop *a priori* hypotheses about their effects. However, a good deal of research addresses the more general question of how formal hierarchy, and the power imbalances it creates, affects team members' cognition and behavior (e.g., Blader, Shirako, & Chen, 2016; Chattopadhyay, Finn, & Ashkanasy, 2010; Galinsky, Gruenfeld, & Magee, 2003; Goodwin, Gubin, Fiske, & Yzerbyt, 2000; Greer et al., 2017; Keltner, Gruenfeld, & Anderson, 2003; Maner & Meade, 2010). We synthesize this work into three propositions that describe the impact of hierarchy on team dynamics. Specifically, we argue that formal hierarchies influence team members' motivation to engage in perspective taking (Proposition 1), engender power sensitivity that affects members' ongoing social identification with the team (Proposition 2), and are contingent upon task characteristics (e.g., task variety) that impact team members' perspective taking accuracy (Proposition 3). These propositions constitute what Davis, Eisenhardt, and Bingham (2007: 482) refer to as "simple theory," concerning the effects of formal hierarchy – that is, "basic processes that may be known…but that have interactions that are only vaguely understood."

In our first study, we use our propositions to develop and parameterize an agent-based computational model that explores the effects of the six formal hierarchical structures in our taxonomy on team decision making and performance. In agent-based models, “fundamental social structures and group behavior emerge from the interaction of individuals operating in artificial environments under rules that place only bounded demands on each agent’s information and computational capacity” (Epstein & Axtell, 1996: 4, as cited in Nan, Johnston, & Olson, 2008). We use our modeling results to craft an expanded, team-level theory of the effects of formal hierarchical differentiation on team performance at high and low levels of member perspective taking accuracy. In our second study, we assess the generalizability of a key theoretical prediction to a specific organizational context and task-based contingency factor. In a survey-based field study of 68 clinical nursing shifts in 5 mid-sized hospitals, we find that formal hierarchy skewness interacts with task variety to predict patient care, providing initial support for our emergent theory.

Our two complementary studies offer several important theoretical contributions. Most significantly, they advance the literature on formal hierarchical differentiation by identifying additional hierarchical structures beyond the pyramid and leaderless team, and suggesting that these alternative structures, and particularly the inverse pyramid, may enhance team performance relative to the pyramid in some circumstances. Second, although prior work has suggested several task-related boundary conditions of formal hierarchical differentiation (Anderson & Brown, 2010; Greer et al., 2018; Halevy, Chou, & Galinsky, 2011), these studies have proceeded in a piecemeal fashion with little unifying theory. We refine prior efforts by proposing that many of the previously identified task moderators of formal hierarchy can be understood in terms of their influence on team members’ perspective taking accuracy. Our second study, which assesses task variety as a contingency factor likely to reduce perspective taking accuracy and yields results consistent with our modeling predictions, reinforces the utility of our approach. Finally, despite the widespread acknowledgement that power is an inherently social phenomenon (French & Raven, 1959), there is minimal theoretical understanding of how formal roles affect emergent power dynamics in team contexts (Huxham & Vangen 2005; Ostrom 2011; Wellman, Newton, Wang, Wei, Waldman, & LePine, 2019). We address this limitation by shedding new light on the behavioral and performance consequences of different approaches to formal hierarchical differentiation in teams. In particular, we find that the tendency of low-ranking team members to mistakenly modify their own behavior based on incorrect assumptions about the preferences of higher-ranking members plays a key role in hampering the performance of positively skewed hierarchies (such as the pyramid) relative to negatively skewed hierarchies (such as the inverse pyramid) under conditions of low perspective taking accuracy. Our modeling results yield several other insights about the effectiveness of various hierarchical forms over time that could be pursued in future studies.

DEVELOPING A TAXONOMY OF FORMAL HIERARCHICAL STRUCTURES

We focus on formal hierarchies, conceptualized as differences in team members' formal authority. Although other hierarchies can and do exist within teams (Bunderson, 2003a; Hays & Blader, 2016; Henrich & Gil-White, 2009; Magee & Galinsky, 2008), several properties of formal hierarchies make them particularly suitable for the present study. Unlike some other hierarchies, formal hierarchies are generally stable (Hays & Bendersky, 2015), which makes it easier to theorize and model their effects over time. Moreover, many hierarchies are implicit – that is, they exist in team members' minds based the members' subjective judgements, which may not coincide (e.g., Kilduff, Willer, & Anderson, 2016). In contrast, formal hierarchies are explicit and prescribed by organizations. As such, they are both readily quantifiable and practically relevant. Finally, although legitimacy has been highlighted as an important boundary condition of hierarchy's effects (Halevy et al., 2011), powerful norms of obedience to authority exist within organizations (DeRue & Ashford, 2010; French & Raven, 1959; Milgram, 1974; Morrison & Milliken, 2003). As a result, a team's formal hierarchical structure is likely to be perceived by members as legitimate – in other words, as "appropriate, proper, and just" (Tyler, 2006: 376). Indeed, other hierarchies are less relevant to group dynamics when formal hierarchical differentiation is also present (Blader & Chen, 2012; Bunderson, 2003b), suggesting that formal hierarchies may often be perceived as *more* legitimate than other types.

Research has explored team-level dispersion in other constructs besides formal hierarchical differentiation (e.g. DeRue, Hollenbeck, Ilgen, & Feltz, 2010; Tzabbar & Vestal, 2015), but these studies have neither been systematic nor comprehensive. Thus, an important aim of the present research was to generate a taxonomy of the possible formal hierarchical structures that might exist in teams. To accomplish this, we considered the structures produced by crossing two concentrations of formal authority (wide and narrow) with three hierarchical levels (low, medium, and high). After thus identifying a set of eight formal hierarchical structures, we assessed the mathematical distribution of formal authority underlying each. As shown in the Appendix, we discovered that two structures (the square and rectangle) embodied the same underlying authority distribution, and two others (the pentagon and inverse pentagon) were hybrid distributions that combined properties of others in the taxonomy. We focused on one representative structure for each of the five "pure type" authority distributions that emerged, as we reasoned this would enable the most powerful, informative, and parsimonious comparisons[1]. We also included the leaderless team due to its prevalence in prior research. The six formal hierarchical structures in our final taxonomy are summarized in Table 1 and discussed in more detail below.

A *pyramid*-shaped formal hierarchy occurs when most of the members of a team have a low or moderate level of formal authority and a few members possess high levels of authority. This structure reflects a positively skewed authority distribution. Pyramid-shaped formal hierarchies abound in organizations, including in what Cohen and Bailey (1997) referred to as "traditional work teams," – continuing work units that are responsible for producing goods or providing services and that are directed by formal supervisors. As Magee and Galinsky (2008: 352) pointed out, "most, if not all, organizations have a stratified structure, a pyramid shape with fewer people at the top than at the bottom." The traditional assumption has been that such hierarchies offer teams numerous benefits, most notably a clear line of command and performance incentives (Magee & Galinsky, 2008). However, recent research has called these benefits into question while revealing previously unappreciated disadvantages of pyramid-shaped hierarchies, including an elevated risk of conflict and the reluctance of lower-ranking members to voice their ideas and perspectives (Greer et al., 2017; 2018; Milliken, Morrison, & Hewlin, 2003).

In addition to the pyramid, the other formal hierarchical structure to receive significant scholarly attention is the *leaderless team*. In teams exhibiting this structure, which are also called self-managing teams (Manz & Sims, 1987), all members have the same level of formal authority.

[1] As a robustness check, we conducted a similar thought experiment with three potential concentrations of hierarchy (low, medium, wide) at each of the three levels of authority. We did not discover any additional pure type authority distributions.

As shown in Table 1, the leaderless team embodies a constant authority distribution. Theories of self-management suggest that a leaderless team formal hierarchical structure can enhance performance by increasing team members' autonomy and involvement in decision-making processes (Cohen, Chang, & Ledford, 1997). However, empirical tests of these predictions have not yielded consistent support (e.g., Barker, 1993; Stewart & Barrick, 2000). Instead, as with pyramid-shaped formal hierarchies, the effects of a leaderless team structure appear to be contingent upon a number of factors, including the type of task the team is working on (Stewart, Courtright, & Manz, 2011).

Teams with *hourglass*-shaped formal hierarchies are evenly divided between members with high levels of formal authority and those with little to no authority. Such a structure reflects a bimodal authority distribution. Surgical teams commonly adopt an hourglass-shaped formal hierarchy. These teams are frequently split between junior and senior operating staff, and surgeons are most comfortable when large differences in formal authority exist between junior and senior members (Sexton, Thomas, & Helmreich, 2000). However, little research has explored the implications of hourglass-shaped formal hierarchies for team performance.

Rectangle-shaped hierarchies occur when a roughly equal number of team members occupy each formal hierarchical level, creating a uniform authority distribution. In a recent article, Yu and colleagues (2019: 2) referred to a rectangular-shaped hierarchy (a structure with a "narrow base and a relatively equally narrow top") as a ladder, and noted that rowing teams employ this sort of hierarchical structure. Although few other instances of rectangular formal hierarchies have been identified, an academic research team composed of an equal proportion of senior faculty members, junior faculty members and doctoral students would qualify. Yu and colleagues' (2019) initial results suggest that rectangle-shaped hierarchies may undermine social relationships and team performance relative to pyramid-shaped hierarchies, but to our knowledge, theirs is the only study that has assessed the effects of a rectangular formal structure.

In a *diamond*-shaped formal hierarchy, most team members have a moderate level of formal authority, and a few members possess low or high authority. This hierarchical structure corresponds to a normal authority distribution. Although diamond-shaped hierarchies have received little research attention, some clinical nursing shifts are structured with one or two managers, a large number of nurses, and a few members who occupy low-level support roles (Duffield, Kearin, Johnston, & Leonard, 2007). The formal structure of such shifts approximates a diamond, but it is unclear how this structure affects performance.

Finally, in teams with an *inverse pyramid*-shaped formal hierarchy, most members have high or moderate formal authority, and only a few members possess low levels of authority. Such a structure reflects a negatively skewed authority distribution. A study by Kaufmann and Seidman (1970) revealed that advisory or support teams (e.g., human resources, accounting, public relations teams) are commonly structured as an inverse pyramid, but the performance implications of such structures are unknown.

UNDERSTANDING THE EFFECTS OF FORMAL HIERARCHICAL DIFFERENTIATION: POWER, PERSPECTIVE TAKING AND SOCIAL IDENTIFICATION

Although scholars have been slow to consider the impact of formal hierarchical structures beyond the pyramid and the leaderless team on team performance, they have begun to identify how hierarchy influences individuals' cognition and behavior. In particular, numerous studies have highlighted the power imbalances created by formal hierarchies as exerting a powerful influence on team members (Greer et al., 2017; Magee & Galinsky, 2008; Tarakci, Greer, & Groenen, 2016). Power is formally defined as the control of valued resources (Galinsky et al., 2003), and being appointed to a high-ranking position in a formal hierarchy serves as a source of power in several ways. Individuals in positions of authority acquire what French and Raven (1959) referred to as legitimate power. This power stems from widely internalized values that individuals with more formal authority have a legitimate right to influence those with less (Weber, 1968). Individuals in formal supervisory positions can also control whether their subordinates are assigned to desirable or undesirable tasks, and get pay raises or promotions. As such, formal authority is a source of both reward power and coercive power; others expect they will be rewarded if they comply with authority figures' influence attempts and punished if they do not comply (French & Raven, 1959).

Although status differentials also have important consequences for group dynamics (e.g., Bunderson, 2003a, 2003b; Kilduff et al., 2016; Li, Chen, & Blader, 2016; Simpson, Willer, & Ridgeway, 2012), status is less likely to be directly influenced by formal hierarchical differentiation than power. Whereas power is commonly defined as access to valuable resources that are often acquired based on one's formal position (e.g., Joshi & Fast, 2013), status is defined as liking, respect, and admiration in the eyes of others (Magee & Galinsky, 2008; Ridgeway, 1982; Willer, 2009). Status is based on the extent to which an individual is perceived to act in a group-oriented or communal manner and is a primarily a property of those who confer it (Hays & Blader, 2016; Gould, 2002; Ridgeway & Erickson, 2000). Thus, relative to power, the effects of formal hierarchical differentiation on status are likely to be more distal, and more contingent upon authority figures' subsequent behavior. Supporting this contention, research exploring the effects of formal authority (e.g., Hall, Coats, & LeBeau, 2010; Kenny, Snook, Boucher, & Hancock, 2010) has revealed that these effects are more similar to those that have been reported for power than for status. Thus, we focus on power differentials as the primary means through which formal hierarchical differentiation effects team dynamics and performance.

An extensive and rapidly growing literature has investigated how power influences team members' thoughts and actions (e.g., Galinsky et al., 2003; Galinsky, Magee, Gruenfeld, Whitson, & Liljenquist, 2008; Greer & Van Kleef, 2010; Greer et al., 2018; Keltner et al., 2003; Maner & Meade, 2010). Below, we draw on this literature to develop three propositions about the effects of formal hierarchical differentiation on team dynamics. These propositions synthesize and formalize the field's current understanding of the consequences of formal hierarchies, and form a "platform from which powerful theory can be developed through the verification and experimentation" enabled by agent-based computational modeling (Davis et al., 2007: 485).

Hierarchy Influences Team Member Perspective Taking Motivation

One important implication of the power imbalances created by formal hierarchical differentiation is their influence on team members' *perspective taking motivation* – that is, members' motivation to comprehend how others within the team think and feel, and to incorporate those perspectives in their own decision making. Higher levels of power are widely thought to engender an egocentric focus and promote the pursuit of personal objectives, (Blader et al., 2016; Fiske, 1992; Gruenfeld, Inesi, Magee, & Galinsky, 2008; Keltner et al., 2003). As Blader and Chen noted (2012: 996), "power liberates people from social and normative pressures, leading them to shift their focus inward and toward their own goals and dispositions." Powerful individuals frequently rely on stereotypes rather than seek information about other people (Goodwin et al., 2000; Hogeveen, Inzlicht, & Obhi, 2014). As a result, powerful individuals are "less likely to attend to, engage with, or value their relations with lower-power counterparts, or those counterparts' needs, perspectives, and opinions" (Blader & Chen, 2012: 995). Instead, they are more likely to take action and make decisions based on their own interests (Galinsky et al., 2003; Keltner et al., 2003). Less powerful individuals, on the other hand, are more motivated to be attentive to and influenced by the social situation – including the thoughts and feelings of authority figures (Galinsky, Magee, Inesi, & Gruenfeld, 2006). Thus, team members are likely to be motivated to take the perspective of other members above them in the hierarchy, but not other members below them in the hierarchy. Supporting this argument, Chattopadhyay and colleagues (2010) found that lower-power members of health care teams (nurses) attempted to consider and support the needs of higher-power members (surgeons), but that surgeons did not attempt to consider and support nurses' needs in the same way.

In identifying targets for perspective taking, team members are likely to look horizontally as well as vertically within their team's formal hierarchy. Team members may feel a sense of kinship and connection with those at their same hierarchical level, increasing their motivation to seek out the views and perspectives of these members (Haslam, 2004). For instance, nurses in health care teams tend to empathize with other nurses because they see them as similar (c.f., Chattopadhyay et al., 2010). However, because formal hierarchies are static, coalition formation between team members at the same hierarchical level is unlikely to result in a permanent change in rank. Thus, although team members may be motivated to take the perspectives of those at their same hierarchical level, they are unlikely to afford these views a disproportionate weight in their decision-making (Chattopadhyay, Tluchowsak, & George, 2004).

The widely recognized influence of power on team members' perspective taking motivation suggests two important consequences of formal hierarchical differentiation for team dynamics. First, team members are likely to attempt to take the perspective of other members of their team who are at or above their own level of formal authority, but not those at lower levels of the hierarchy. Second, team members with more formal authority are likely to weight their own preferences more heavily in their decision making (relative to the perceived preferences of others).

Proposition 1. Formal hierarchical differentiation influences team members' perspective taking motivation, such that members attempt to take the perspectives of others at or above the own hierarchical level, but not those below their hierarchical level, and weight their own preferences more heavily in their decision making the more formal authority they possess.

Hierarchy Increases Power Sensitivity and Affects Team Member Social Identification

Formal hierarchy is also thought to make individuals very attentive to their personal level of power. Indeed, Greer and colleagues (2017: 112) proposed that the members of hierarchically differentiated teams experience heightened power sensitivity, making them unusually "perceptive of, affected by, and responsive to, resources within the team." Drawing from the group engagement model of team dynamics (Blader & Tyler, 2009; Tyler & Blader, 2003), we propose that the power sensitivity engendered by formal hierarchical differentiation is likely to manifest itself via team members' heightened focus on the outcomes of collective decision making, which influences their subsequent social identification with the team and corresponding perspective taking motivation. The members of hierarchically differentiated teams are likely to pay close attention to team decisions, as this is an important marker of resource allocation within the team (Greer et al., 2017). When the team's decisions align with members' personal values and preferences, they are likely to feel happy and secure. These feelings of pride and safety are likely to enhance members' experience of social identification – that is, their perception of oneness and belongingness with the team (Ashforth & Mael, 1989). In contrast, when team members feel like their personal goals and objectives are threatened by their team's decisions, or that the outcomes of these decisions are unfair, their social identification is likely to decrease (Blader & Tyler, 2009; Chattopadhyay et al., 2004).

Members' social identification with the team has important implications for their ongoing perspective taking motivation. As Blader and Tyler (2009: 446) noted, "group members with strong social identities vis-à-vis-the group are intrinsically motivated to facilitate the viability and success of their group. Because their group is integrated with their self-concept… these individuals are inherently concerned with the group's welfare and are therefore likely to behave on behalf of their group's interests." As aspect of this group-oriented behavior is likely to include seeking out other members' views, ideas, and perspectives, and incorporating these perspectives into their own decision making (Fiske, 1992; Wellman, 2017). Thus, we propose that the enhanced social identification experienced by members of hierarchically differentiated teams who perceive team outcomes to be fair and personally beneficial increases these members' perspective taking motivation (c.f., Pettit & Lount, 2010). In contrast, the lower levels of social identification experienced by members of hierarchically differentiated teams who perceive team outcomes to be unfair or personally harmful may cause these members to focus more narrowly on their own goals (Ashforth & Mael, 1989; Blader & Tyler, 2009; Tajfel & Turner, 1986). Such a self-focus is likely to reduce members' motivation to seek out others' views, and render them more likely to base their decisions on their personal needs and priorities (c.f., Pettit, Doyle, Lount, & To, 2016).

Proposition 2. Formal hierarchical differentiation increases team members' power sensitivity, such that team decisions have a stronger influence on their social identification with the team and subsequent perspective taking motivation.

Hierarchy's Effects are Contingent on Task-Driven Differences in Team Member Perspective Taking Accuracy

Finally, research has shown that the effects of formal hierarchy on team performance are contingent upon the team's task work. However, existing studies have provided few consistent insights into the nature of these moderating effects. We address this limitation by proposing that many of the task-related boundary conditions of formal hierarchies operate by influencing team members' ability to gauge one another's ideas, feelings, and opinions correctly, which we refer to as *perspective taking accuracy*. Some kinds of task work make it relatively easy for team members to assess one another's views and preferences if they are motivated to do so. For instance, members of teams whose work is low in task variety are likely to have previously worked together on a task similar to the one they are currently performing. The repetitive nature of the team's work may enable motivated members to use others' prior behavior or preferences to assess how others would prefer they complete their current task (Galbraith, 1973). In contrast, understanding one another's task-related preferences may be more difficult for the members of teams that work on tasks that are novel or unpredictable (high in task variety). Even if the members of such teams are motivated to incorporate others' ideas and perspectives into their decision-making, they may have difficulty doing so if they are working on a task that is dramatically different from those they have completed with their teammates in the past. Several other task attributes in addition to task variety are also likely to impact team members' perspective taking accuracy (e.g., task interdependence, Halevy et al., 2011; task complexity, Greer et al., 2018). We focus on task variety here to illustrate how one specific task feature can affect perspective taking accuracy, and because task variety is featured in our second study.

Our identification of team member perspective taking accuracy as a critical mechanism through which task attributes influence the effects of formal hierarchical differentiation is consistent with prior arguments. For instance, Anderson and Brown (2010) noted that formal hierarchical differentiation is more effective for simple, routine tasks, where communication is easy and decision-making is straightforward – in other words, when team member perspective taking accuracy is high. Greer and colleagues (2018: 9) similarly proposed that task characteristics can change the effects of formal hierarchy by influencing members' ability to "integrate and align individual member actions, knowledge, and objectives towards the attainment of common goals." Our focus on perspective taking accuracy is also appropriate given the need to identify hierarchical forms that can enable teams to maintain high levels of performance in complex, novel, and ambiguous task environments (Uhl-Bien et al., 2007; Weick, Sutcliffe, & Obstfeld, 1999). Incorporating these and related task-based contingencies into our theorizing via perspective taking accuracy allows us to maintain a clear conceptual focus on perspective taking while exploring the performance of alternative hierarchical structures across different types of task environments.

Interestingly, although scholars have consistently asserted that task characteristics impact the effectiveness of formal hierarchies, the direction of this relationship is less clear. Anderson and Brown (2010) proposed that pyramid shaped formal hierarchies are most beneficial for teams facing stable, predictable tasks, whereas Greer and colleagues (2018) found that pyramids are most helpful for teams facing high coordination demands. Because little research has explored the alternative hierarchies in our taxonomy, and research examining the moderating effects of task type on the pyramid and leaderless team structures has yielded inconsistent findings, we propose simply that task-driven differences in team member perspective taking accuracy influence the effects of formal hierarchical differentiation. We leave the nature and direction of this influence as an open question to be addressed in our agent-based modeling.

Proposition 3. The effects of formal hierarchical differentiation are contingent on task-driven differences in team members' perspective taking accuracy.

STUDY 1: EXPLORATORY AGENT-BASED MODELING

An important research objective was to explore the implications of alternative formal hierarchical structures for team performance. However, the methodologies most commonly used in organizational research were poorly suited for such an effort. The prevalence of pyramid-shaped hierarchies made it challenging to locate enough real-world teams with alternative forms to conduct a field study. Due to the large number of alternative structures and the difficulty recreating the influence of formal authority in the lab, a controlled experiment was also impractical. In any case, because little research has examined some of the hierarchical structures in our taxonomy, we were unable to formulate hypotheses about their consequences *a priori*.

To overcome these difficulties, we developed an agent-based computational model of team decision making and used it to generate new insights concerning the effects of the six hierarchical structures in our taxonomy. Agent-based modeling has been used to study phenomena such as information diffusion and social change (Carley, 1991), transactive memory in teams (Ren, Carley, & Argote, 2006), the exchange of goods in markets (Epstein & Axtel, 1996), and emergent leadership (Will, 2016). The actors in these models are computer-generated "agents," that produce data as they interact based on behavioral rules that are specified by the researcher and motivated by the relevant literature. Agent-based modeling allowed us to instantiate the agents in simulated teams with behavioral rules consistent with our propositions, and then conduct a virtual experiment to uncover new insights about the implications of the formal hierarchical structures in our taxonomy for team dynamics and performance.

Simulation Approach

Scholars have proposed that parsimony should be the principle concern in creating the behavioral rules in agent-based models (Burton & Obel, 2011). A model does not need to be completely realistic. Rather, it should focus on the elements of cognition and behavior that are most pertinent to the research question under investigation (Axelrod 1997; Cohen & Cyert 1965; Harrison, Lin, Carroll, & Carley, 2007). With this overriding design principle in mind, we created an agent-based model of decision making in teams in which members have different information and/or preferences (Denison, Hart, & Kahn, 1996; Pearce, 2004). Table 2 and Figure 1 summarize the model's key decision rules and parameters. The complete code and documentation for the model is published in the Network for Computational Modeling in Social and Ecological Sciences (CoMSES) model library, an open-source digital repository. The model can be accessed at https://www.comses.net/codebases/5863/releases/1.1.0/

Teams in the model must make a collective decision about which of two courses of action to pursue. Each team member (agent) is randomly seeded with a utility score for each of the two options, which represents the value they attach to that option. Team members' utility scores differ to represent their unique backgrounds, priorities, and access to information. We use the terms "individual optimum" to describe the option for which an individual has the highest utility score, and "team optimum" to describe the option for which the sum of all team members' utility scores are greatest. The team follows a decision-making process in which each member votes for one of the two options by implementing a set of decision rules that are described in more detail below. The team chooses the option that receives the most votes and then proceeds to the next decision.

Decision Rules

Perspective taking motivation. Proposition 1 argues that formal hierarchical differentiation influences team members' perspective taking motivation. We operationalized this proposition in two ways. First, team members attempt to incorporate the utility scores of all other members' whose formal authority equals or exceeds their own (net the social identification adjustment described below) into their final vote. Second, when deciding how to vote, team members' weight their own utility score based on their level of formal authority.

Social identification adjustment. To account for the enhanced power sensitivity of members of hierarchically differentiated teams discussed in Proposition 2, team members in the model update their perspective taking motivation based on their team's prior decision. This dynamic updating is operationalized through a "social identification adjustment." When the social identification adjustment increases, team members incorporate the perceived utility scores of more other members into their vote. When the social identification adjustment decreases, members incorporate the perceived utility values of fewer other members in their vote. This dynamic is consistent with Proposition 2 in that when members view their team's prior decision as fair and beneficial their social identification increases, which enhances their subsequent motivation to promote the collective good through perspective taking (Blader & Tyler, 2009; Tyler & Blader, 2003).

Initially, the social identification adjustment is set to zero for all team members. However, as shown in Table 2 and Figure 1, a member's social identification adjustment updates over time based on the team's prior decision compared to both the member's personal optimum and the team optimum. When the team selects a member's optimum choice, the member's social identification adjustment increases by one, such that for the next vote the member lowers their threshold for incorporating other members' perceived utility scores by one level of formal authority. When the team does not select a member's optimum choice, their social identification decreases, which we operationalize by either subtracting one from the social identification adjustment (when the team selects the team optimum choice) or completely resetting the social identification adjustment and having the member vote exclusively on the basis of their own utility score in the next round (when the team does not select the team optimum choice). The reduction in social identification and perspective taking motivation is most severe when the team selects an option that is neither the member's own optimum, nor the team optimum, because members are likely to perceive such a decision as both personally harmful and unfair.

Model Parameterization

Our modeling simulations took the form of 6 x 2 between-team design. We assessed the performance of each of the six formal hierarchical structures in our taxonomy at both high and low levels of team member perspective taking accuracy. We simulated 500 teams in each cell of our design. We set team size at 9, as this team size is commonly observed and generally consistent with other team-based simulation studies (e.g., Tarakci et al., 2016). We set each simulated team to engage in 300 decisions.

Formal hierarchical differentiation. We assigned each team one of the six formal hierarchical structures in our taxonomy. Within each team, we specified five different levels of formal authority, to approximate the levels of authority present in the typical organization. We parameterized the six structures using the five authority levels as described in the published model, and assigned each member an authority level based on the team's assigned structure.

Perspective taking accuracy. To capture the effects of task contingency factors that influence perspective taking accuracy, we adjusted team members' perception of other member's utility scores by an error factor of either zero (high perspective taking accuracy condition) or within the range of plus or minus 3.33 (low perspective taking accuracy condition)[2].

Thus, for each voting round, each team member's vote can be represented as:

$$v = u_{self}a_{self} + \sum_{i \in links}(u_i + e_i)$$

Where u_{self} is the member's own utility score, a_{self} is the member's level of formal authority, *links* are the other team members whose perspective the focal member is motivated to consider (calculated as all members with authority greater than or equal to a_{self} – *social identification adjustment*), u_i is the utility value of a linked team member, and e_i is an error factor reflecting perspective taking accuracy.

Outcome: Team optimal decisions. We operationalized team performance as the percentage of "team optimal" decisions made by the 500 teams in each cell of our design. A team makes a team optimal decision when it selects the team optimum option.

Results

Figure 2 depicts the modeling results. As shown, the model generates several interesting dynamics. In describing our findings, we focus on the pyramid and leaderless team, as they are the two structures in our taxonomy that have received significant prior attention, as well as the inverse pyramid, because the results for this structure depart most dramatically from the pyramid. The relative performance of the pyramid, leaderless team, and inverse pyramid structures at different levels of perspective taking accuracy demonstrates the model's ability to

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[2] We selected 3.33 because it is the average difference in members' utility scores in each round of the simulation.

tease apart team-level consequences from complex combinations of variables. When perspective taking accuracy is high, the pyramid is the best-performing structure (99.96% team optimal decisions), and the inverse pyramid is the worst performing structure (95.06% team optimal decisions). At low perspective taking accuracy, the performance of all the structures decreases and their ranking changes. The inverse pyramid yields the highest percentage of team optimal decisions (86.52%), and the pyramid yields the lowest percentage (81.31%). The leaderless team performs similarly to the inverse pyramid, with team optimal decision rates of 95.98% and 84.63% at high and low levels of member perspective taking accuracy respectively.

Figure 2 further reveals that the rectangle and diamond structures are most robust to task-driven differences in team member perspective taking accuracy. The rectangle is the third best-performing structure at high accuracy (98.37% team optimal decisions), and the fourth best-performing structure at low accuracy (83.54% team optimal decisions, while the diamond ranks fourth under conditions of high accuracy (96.33% team optimal decisions) and third under conditions of low accuracy (83.87% team optimal decisions).

Other interesting trends in the data emerge over time. As shown in Figure 2, across both levels of perspective taking accuracy, the performance of the leaderless team and diamond structures becomes more similar as the number of decisions increases. Additionally, the performance of several structures (i.e., the leaderless team, diamond, rectangle, and hourglass) converges over decisions at low perspective taking accuracy, whereas this convergence does not occur to the same degree at high accuracy. In addition to these larger-scale patterns, team performance tends to fluctuate dramatically over the first ten decisions, and then moderately over the next 20-30 decisions before stabilizing. The fluctuations are particularly evident under conditions of low perspective taking accuracy. These results suggest that it may take some time for the true effects of a particular formal hierarchical structure to manifest, particularly for teams working in diverse, complex, or ambiguous task environments.

Sensitivity Analyses

We conducted additional simulations to check the robustness of our findings to variations in model decision rules and parameters. First, we re-ran our model using a range of different team sizes from 5 to 20. The pattern of results and the relative performance of the six distributions does not change across different team sizes.

We also simulated the performance of the pyramid, reverse pyramid, and leaderless team structures with team sizes of 5, 9 and 12 and a wider range of team member perspective taking accuracy. We did this by varying the error parameter associated with team members' perceptions of others' utility scores from 0 to 5. As shown in Figure 3, across all three team sizes performance generally decreases with increased error (reduced perspective taking accuracy). The inverse pyramid structure begins to outperform the pyramid at a perspective taking error value of around 1.66, or roughly half the average difference between team members' utility scores, and overtakes the leaderless team at a perspective taking error value of between 2 and 3.5.

Finally, we reasoned that team members who vote for an option that is not their own optimum might consider it less unfair when their team selects that option. To address this possibility, we re-ran our simulation with a modified social identification factor in which team members compare the team decision to their own vote rather than their own optimum. The rankings of the pyramid, leaderless team, and inverse pyramid structures at low and high perspective taking accuracy did not change. These findings increase our confidence in the stability of the reported results.

Towards an Expanded Theory of Formal Hierarchical Differentiation

In addition to predicting the performance of the six formal hierarchical structures in our taxonomy, the model sheds light on the team processes that are the most critical drivers of performance. To explore these mechanisms, we compared the dynamics engendered by the pyramid and inverse pyramid structures, as they exhibited the greatest performance differences. We discovered that the team-level differences in performance depicted in Figure 2 are due to disparities in members' team optimum voting rates – that is, their likelihood of voting for the team optimum option. Teams in which more members vote for the option that is best for the team as a whole are more likely to select that option, yielding better performance.

We further found that members' team optimum voting rates are a function of the interaction of their formal authority and their task-driven perspective taking accuracy. Specifically, as shown in Figure 4, formal authority is negatively associated with a member's likelihood of voting for the team optimum option when perspective taking accuracy is high, but positively associated with a member's likelihood of voting for the team optimum option when perspective taking accuracy is low. Additional investigation revealed that this interaction effect is due to the influence of formal authority on team members' perspective taking motivation. As described in Proposition 1, members lower in formal authority place relatively little weight on their own utilities relative to the perceived utilities of others when voting. When perspective-taking accuracy is high, the enhanced perspective taking motivation of low-ranking team members improves their team optimum voting rate. In instances where low-ranking members' own utility scores depart from the team optimum choice, their enhanced other-focus enables them to identify the discrepancy and vote against their personal utility in favor of the team optimum choice. However, when perspective taking accuracy is low, low-ranking team members are more likely to misperceive the true utilities of those higher in the formal hierarchy. As a result, for some decisions they *incorrectly* vote against their own utility in favor of a choice that they perceive to be the team optimum solution but that is actually not. This type of mistake would be akin to nursing assistant on a health care team ignoring her own intuition about how to care for a patient and instead using an approach that she thought the team's nurses would prefer, when in reality those nurses would have desired her to take the course of action she was initially considering. Such well-intentioned perspective taking errors reduce the team optimum voting rates of low-ranking team members when perspective taking accuracy is low.

In contrast, as noted in Proposition 1, team members with more formal authority weight their own preferences more heavily than the perceived desires of others when voting. When perspective taking accuracy is high, high-ranking members' low perspective taking motivation harms their team optimum voting rate, because they do not adjust their vote to conform to the needs of other team members. Instead, high-ranking members usually vote for the option for which their personal utility is highest, even when most of the other members of their team prefer a different option. When perspective taking accuracy is low, however, the self-focus of high-ranking team members paradoxically yields a performance advantage. Because high-ranking team members are less likely to attempt to incorporate others' views and preferences into their votes, there are fewer instance where they incorrectly vote against their own utility due to a misinterpretation of those preferences. To return to the previous example, our results imply that if the team member in question were a charge nurse rather than a nursing assistant, she would be more likely to treat the patient based on her own (correct) intuition about what constitutes appropriate care, rather than making an error by deviating from her own intuition due to misperceiving other team members' preferred course of action.

Thus, the individual-level relationships between formal authority and team optimum voting rate at low and high perspective taking accuracy explain the team-level performance differences between the pyramid and inverse pyramid structures. Teams with a pyramid-shaped formal hierarchy contain more members low in formal authority than those with an inverse pyramid-shaped hierarchy. Because the team optimum voting rate of low-ranking members is higher than that of high-ranking members at high perspective taking accuracy, teams with pyramid-shaped formal hierarchies outperform teams with inverse-pyramid shaped hierarchies under these conditions. However, when a team's task work reduces members' perspective taking accuracy, the team optimum voting rate of high-ranking team members exceeds that of low-ranking members, and the inverse pyramid structure yields more team optimal decisions than the pyramid.

We used the insights we gleaned from our modeling results to develop an expanded, team-level theory of formal hierarchical differentiation and team performance. Figure 5 depicts the theory's key predictions. The theory operationalizes the proportion of team members with high versus low authority in terms of *formal hierarchy skewness.* Teams that adopt positively skewed formal hierarchies (such as the pyramid) have a high concentration of members that are low in formal authority, whereas teams with negatively skewed formal hierarchies (such as the inverse pyramid) have a large proportion of members with relatively high levels of formal authority. Extending Proposition 1, we propose that at the team level, formal hierarchy skewness is positively associated with team member perspective taking motivation. As we have discussed, because teams with positively skewed formal hierarchies contain more low-ranking members than those with negatively skewed hierarchies, the members of positively skewed teams are, on average, more motivated to seek out others' views and preferences of others and to incorporate these preferences into their own decision making.

Extending Proposition 3, we further propose that team member perspective taking motivation interacts with task-driven differences in perspective taking accuracy to predict team performance. Whereas the literature did not allow us to make an initial prediction concerning the direction of this interaction effect, with the benefit of our modeling results we can be more precise. Specifically, we propose that the increased team member perspective-taking motivation engendered by positively skewed formal hierarchies such as the pyramid improves the performance of teams that work on tasks that facilitate members' perspective-taking accuracy (e.g., tasks low in variety), but harms the performance of teams with task work that makes it more challenging for members' to accurately assess one another's preferences (e.g., tasks high in variety). For teams facing highly variable task conditions, a negatively skewed formal hierarchical structure such as the inverse pyramid is likely to yield optimal performance. We further extend Proposition 3 by identifying members' team-optimal behavior – the degree to which members behave in a way that is consistent with the preferences of the majority of other team members - as an important mediator of the predicted interaction effect.

Discussion

We utilized agent-based computational modeling to explore the performance implications of six formal hierarchical structures, including four structures that organizational research has rarely considered. Consistent with our initial theorizing, we found that team member perspective taking accuracy plays an important role in determining the structures' relative effectiveness. However, our modeling results enabled us to make a clearer prediction about the pattern of this interaction effect. Specifically, we found that positively skewed formal hierarchical structures such as the pyramid outperform negatively skewed formal structures such as the inverse pyramid in task conditions in which team members' perspective taking accuracy is high, whereas negatively skewed structures yield optimal performance when team member perspective-taking accuracy is low. These results are robust to several variations in model parameters and decision rules. We conducted additional analyses to uncover the team dynamics explaining the relative performance of the pyramid and inverse pyramid structures, and these results enabled us to extend our initial propositions and develop a team-level theory of the association between formal hierarchical differentiation and team performance.

It is important to note that our expanded theory is based on only a subset of the insights and comparisons enabled by our modeling results – other aspects of our findings might serve as fertile ground for additional theoretical development. Moreover, this was an inductive study featuring simulated teams. Thus, an important next step was to assess the generalizability of our emergent theorizing to organizational teams.

STUDY 2: CONFIRMATORY FIELD STUDY

We tested a central prediction of our expanded theory in a field study of clinical nursing shifts in five mid-sized hospitals in the Midwestern United States. Clinical units in hospitals are those that are directly responsible for treating patients (e.g. Intensive Care, Radiology, and Maternity), and providing high-quality patient care is their primary purpose. Because patients in many units required round-the clock observation and assistance, nursing work in clinical units is organized into shifts. Shift membership at the five hospitals was mostly fixed, such that each shift operated as a relatively autonomous work team. All of the hospitals were not-for-profit and they ranged in size from 60-300 beds.

There are several important parallels between clinical nursing shifts and the simulated teams in Study 1. First, nursing shifts typically have some form of formal hierarchical differentiation. Second, like the team members in Study 1, shift members frequently possess diverse backgrounds and experiences that can cause them to have unique insights and ideas about how to treat patients. More senior shift members are typically more informed about organization-level policies, concerns, and constraints, whereas lower-level members are typically most attuned to the needs and issues arising from particular patients (c.f. Haig, Sutton, & Whittington, 2006). As a result, clinical nursing shifts may operate more effectively to the extent that members are able to incorporate one another’s ideas, views, and perspectives into their patient care activities and decisions (Mickan & Rodger, 2005). To facilitate this type of coordination, many of the shifts in this study performed daily “huddles” that all members attended and in which members were encouraged to raise any issues they might be facing regarding patient care and contribute suggestions and ideas.

Hypothesis Development

We selected task variety as an aspect of clinical nursing work that is likely to reduce shift members’ perspective taking accuracy. Task variety refers to the extent to which shift members must perform many different tasks to fulfill their job responsibilities (Humphrey, Nahrgang, & Morgeson, 2007). Members of shifts higher in task variety more frequently experience unexpected and novel events (Daft & Macintosh, 1981). As a result, it may be more challenging for members to have a clear sense of others’ preferences and viewpoints about how to proceed, reducing perspective taking accuracy. In contrast, when a shift repeatedly works on the same type of task, members should have a clearer sense of one another’s desired task outcomes, increasing perspective taking accuracy (Galbraith, 1973). We focused on task variety rather than the other task characteristics that may influence team members' perspective taking accuracy (e.g., task interdependence, task complexity) because our initial interviews suggested that the shifts in our example exhibited more variation in task variety than in these other variables. Shifts in some units (e.g., Emergency Room, Surgery) faced the types of novel, unpredictable work likely to engender a high level of team member perspective taking error (high task variety), whereas work in other units (e.g., Long Term Care, Behavioral Health) was much more stable and repetitive (low task variety).

In keeping with our expanded theory and modeling results, we hypothesized that task variety interacts with formal hierarchy skewness to influence the quality of patient care clinical nursing shifts provide. As noted, each member of a shift brings a unique perspective to what constitutes appropriate care, and improved care is likely to occur when shifts integrate these diverse perspectives. Because most of the members in shifts positively skewed formal hierarchies are relatively low in formal authority, they may rely less on their own ideas about how to proceed when caring for patients, and more on the perceived views and preferences of those higher in the hierarchy. When task variety is lower, the adjustments low-ranking shift members make to their patient care activities due to their perspective taking motivation are more likely to yield improved care, because members are likely to be able to correctly assess how higher-ranking members within the shift would prefer they proceed. However, when task variety is higher, members of shifts with positively skewed formal hierarchies may make incorrect assumptions about how more senior members in the shift would prefer that they complete their work. These assumptions may cause them to incorrectly deviate from their own ideas and preferences in treating patients, reducing the quality of care they provide.

In contrast, clinical nursing shifts with negatively skewed hierarchies have more members who are relatively high in formal authority. Thus, members of these shifts, on average, are likely to be lower in perspective taking motivation. As such, they may be less influenced by other shift members' perceived preferences and values, and more likely to care for patients based on their own views about what is important. When task variety is lower, this approach may cause members of shifts with inverse pyramid formal hierarchies to miss opportunities to improve their approach to treating patients by incorporating other team members' desires and preferences. However, when task variety is higher, members of negatively skewed formal hierarchies may be less likely than members of positively skewed hierarchies to incorrectly deviate from their own preferred approach to treating patients, yielding better care.

Hypothesis 1. Task variety moderates the association between formal hierarchy skewness and patient care, such that this association is more negative when task variety is higher than when task variety is lower.

Survey Distribution

We tested Hypothesis 1 and explored the prevalence of the six formal hierarchical structures in our taxonomy in an organizational setting with a field study using archival data and two online surveys of the members of 135 clinical nursing shifts. We administered the surveys three to four months apart. We used archival data to assess the shift's formal hierarchies, measured task variety and demographics on the Time 1 survey, and assessed patient care on the Time 2 survey. To improve the response rate, the first author visited each hospital while data collection was in progress, spoke with members of each participating shift, and distributed fliers explaining the study in more detail. Additionally, units that achieved a high response rate received a pizza party, and individuals who completed each survey were entered into a random drawing for gift cards ($10-$20 value).

We received 1,104 completed Time 1 surveys and 932 completed Time 2 surveys. We excluded shifts for which the response rate for either survey was less than 40%[3], or that did not have at least three members. This resulted in a final sample of 68 shifts. The included shifts contained 1,166 employees, with a mean shift-level response rate of 66% for the Time 1 survey and 60% for the Time 2 survey. Survey respondents in included shifts had an average age of 44.01 years, (*SD* = 7.49) and an average organizational tenure of 10.61 years (*SD* = 5.45). Eighty-nine percent of these participants were female, 93% were Caucasian, and the median level of education was a Bachelors' degree.

Measures

Unless otherwise indicated, all measures used a five-point, Likert-type scale (1 – Strongly disagree, 5 – Strongly agree).

Although the Cronbach's alpha is the most commonly used index of internal consistency reliability, methodologists have called its appropriateness into question (e.g., Bentler, 2007; Cortina, 1993; Geldhof, Preacher, & Zyphur, 2014). Alternative indices can yield a more accurate estimate of internal consistency, particularly for scales that do not adhere to tau equivalence (i.e., have items with factor loadings of different strengths), have items that are not normally distributed, are shorter than ten items, have items with correlated errors, or are not unidimensional (McNeish, 2017). The scales in this study are relatively short and do not adhere to tau equivalence. For measures with these characteristics, Cronbach's alpha reliability

[3] As a robustness check, we re-ran our analyses when raising our exclusion criteria to at least 50% shift-level responsiveness for each survey. This change reduced the sample size (*n* = 43 shifts) but did not change the pattern or statistical significance of our results.

estimates can depart from the true values by as much as 20% (Green & Yang, 2009). Thus, consistent with McNeish's (2017) recommendations, we assessed the internal consistency reliability of our measures by using R Studio to calculate Revelle's omega total based on a polychoric covariance matrix (see McNeish, 2017: 430 for the formula for Revelle's omega total). Revelle's omega total never yields a less accurate estimate of internal consistency reliability than Cronbach's alpha, and provides a more accurate estimate for scales that violate the alpha's underlying assumptions. Because Revelle's omega total estimates the same underlying quantity as Cronbach's alpha, the same guidelines apply for its interpretation (historically, values at or above .70 have been viewed as indicating acceptable internal consistency reliability, although see Schmitt, 1996; Cho & Kim, 2015).

Formal hierarchy skewness.

We assessed the skewness of participating shifts' formal hierarchies using archival data. Prior to the Time 1 survey, the first author visited each hospital and interviewed a member of the Human Resources department, as well as another contact at the Vice President level or higher, typically the Chief Nursing Officer. Consistent with previous research assessing hierarchy (e.g. Battilana & Casciaro, 2012), the first author reviewed a list of job titles with interview participants and asked them to group the jobs by formal authority. There was substantial consensus that the jobs could be grouped using a five-tier system, with jobs at lower levels reporting to those at higher levels. After establishing a preliminary classification system, the first author shared it with selected informants and made minor revisions based on their feedback. We used the resulting system to assess team members' formal authority. At Level 1 of the classification system are support positions such as nursing assistants, clerks, and techs. Level 2 contains the shift members most directly involved with patient care, for instance nurses, social workers, and physical therapists. Level 3 consists of low-level managerial positions such as patient care coordinator and office coordinator. Level 4 contains middle managers: for instance, nurse managers and unit supervisors. The most senior managers in this study (e.g., directors, vice presidents) reside at Level 5.

We assigned every member of participating shifts an authority value based on the level of the classification system in which their job fell (e.g., nurses were assigned twos). We then used these values to compute the skewness of the shifts' formal hierarchical structures.

Task variety. We measured task variety on the Time 1 survey using the three-item skill variety subscale from the Job Diagnostic Survey (Hackman & Oldham, 1980). We adapted the items to pertain to the tasks performed by the shift as a whole. An example item is, "There is a great deal of variety in the work performed by this shift." The internal consistency reliability for this scale was .75.

Patient care. We operationalized shift performance in terms of patient care. Because providing high quality care is a central goal of all clinical shifts, this measure of performance enabled a meaningful comparison across shifts with very different core activities. On the Time 2 survey, participants assessed the quality of care their shift provided to its patients using five items adapted from the SERVQUAL measure of perceived service quality (Parasuraman, Zeithaml, & Berry, 1988). During the initial interviews, the first author worked with senior stakeholders at the research sites to identify which items from the larger scale were most appropriate for the context and to customize the items for use in clinical nursing shifts. The five items are "Overall, this shift provides outstanding care to its patients," "This shift is responsive to the needs of individual patients," "This shift provides its patients with service in a timely manner," "This shift makes many errors in treating its patients," and "This shift's patients are typically satisfied with the quality of care they receive." The internal consistency reliability for this measure was .92.

Control variables. We controlled for several aspects of clinical nursing shifts that might affect the association between formal hierarchical differentiation and patient care. Because females are more likely than men to engage in social facilitation (Eagly & Karau, 1991), gender may be associated with perspective taking motivation and thereby influence care. Conversely, when the members of a team are more highly educated or longer tenured, they may be more likely to rely on their own views and perspectives when caring for patients, and less likely to be motivated to seek out the views of other members (George & Chattopadhyay, 2002). To guard against these potential biases, we controlled for shift members' *gender* (% female), *education*, and *organizational tenure*. We also controlled for *shift size* because larger shifts may be more likely to have positively skewed formal hierarchies, and may also be more susceptible to coordination challenges that reduce performance (LePine, Piccolo, Jackson, Mathieu, & Saul, 2008). We controlled for the *average formal authority* in participating shifts to ensure any results that we observed are due to the distribution of formal authority within the shift rather than members' overall level of authority within their organization. Finally, recent work (Greer et al., 2017; 2018) has identified interpersonal conflict as an important pathway through which formal hierarchical differentiation affects team outcomes. To rule out conflict as a potential alternative explanation, we controlled for *conflict* using the 8-item measure of task and relationship conflict developed by Jehn (1995). The internal consistency reliability of the conflict measure was .96. The pattern and significance levels of the results we report below do not change when these control variables are omitted.

Results

Before testing our hypothesis, we considered the extent to which the six formal hierarchical structures in our taxonomy were present in our data. We used the authority values based on participants' job titles to create a histogram of the distribution of formal authority within each shift, and coded these histograms using an approach similar to that described by Mehra, Smith, Dixon, & Robertson (2006). Two independent coders visually inspected the histograms and indicated which of the six hierarchical structures in our taxonomy they most closely represented. The initial coding matched for 82% of the shifts (Cohen's $\kappa = .73$). The coders met to discuss their discrepancies and arrive at a final code for each shift's formal hierarchical structure. Table 3 summarizes the coding results. As shown, the most common structure was the pyramid, which was used by 45% of participating shifts. However, there were also shifts with formal structures that more closely approximated other forms – most notably the inverse pyramid (19% of shifts) and the diamond (17% of shifts). Table 3 also includes the average level of patient care provided by shifts with each of the six structures, although we caution that the sample size is too small to enable meaningful comparisons.

Table 4 displays the descriptive statistics and intercorrelations among study variables. The nursing shifts in this study were nested in units and hospitals. The number of shifts per unit was too low to model unit-level variation ($M = 1.43$ shifts, $SD = .65$), so we followed the recommendation of West, Welch and Galecki (2007) and collapsed the data across this level. Preliminary analyses revealed a marginally significant hospital-level effect on patient care [$ICC1 = .09$, $ICC2 = .56$, $F(4, 63) = 2.28$, $p = .07$]. To account for this effect, we tested our hypotheses by using the MIXED procedure in SPSS v. 24 to fit a series of linear mixed models (West et al., 2007). MIXED adjusts parameter estimates to account for the presence of correlated errors among clustered observations. All of our focal variables are at the shift level, so we specified only fixed effects. To facilitate the interpretation of interaction terms, we grand-mean centered our continuous predictor and control variables prior to entering them into the models (Hofmann & Gavin, 1998). As a measure of effect size, we calculated pseudo-R^2 values (Hoffman, Griffin, & Gavin, 2000; West et al., 2007), which represent the percentage of the within-hospital variance in patient care accounted for by each model.

Table 5 summarizes the results. Hypothesis 1 predicts that hierarchy skewness is more negatively associated with patient care when task variety is higher than when task variety is lower. As shown, the interaction between formal hierarchy skewness and task variety is a significant predictor of patient care (*b* = -.15. *SE* = .06, *p* = .02). To interpret this interaction, we plotted the association between formal hierarchical differentiation and patient care at low (- 1 *SD* from the mean) and high (+ 1 *SD* from the mean) values of task variety, as suggested by Aiken & West (1991). As shown in Figure 5, when task variety is high, formal hierarchy skewness is negatively associated with patient care (*b* = -.09, *SE* = .03, *p* = .01). However, when task variety is low, formal hierarchy skewness is not significantly associated with patient care (*b* = .00, *SE* = .03, *p* = .92). These results support Hypothesis 1.

Discussion

We assessed the prevalence of the formal hierarchical structures in our taxonomy, as well as the generalizability of a key prediction of the emergent theory from Study 1, with a field study of clinical nursing shifts at five mid-sized hospitals. We operationalized team performance as patient care, and assessed task variety as a contingency factor likely to impact members' perspective taking accuracy. Although the vast majority of prior research has focused on pyramid-shaped hierarchies, many of the shifts in our sample adopted alternative structures, in particular the inverse pyramid and the diamond. Consistent with our hypothesis and modeling results, we also found that a negatively skewed formal hierarchy enhances patient care relative to a positively skewed hierarchy when task variety is higher, but not when task variety is lower. Thus, the results of Study 2 provide initial support for the validity of our Study 1 findings.

OVERALL DISCUSSION

The effectiveness of pyramid-shaped formal hierarchies is limited under some conditions (Anderson & Brown, 2010; Bunderson et al., 2016; Greer et al., 2018), but scholars have been slow to consider alternatives. To explore new ways of seeing formal hierarchy, we developed a taxonomy of six pure type hierarchical structures, including four that have received little to no research attention. In our first study, we used agent-based modeling to explore how the six structures affect team performance at high and low levels of team member perspective taking accuracy. We observed that although a pyramid-shaped formal hierarchy yields the best performance at high perspective taking accuracy, at low accuracy it becomes the worst performing structure, and the inverse pyramid performs best. We conducted additional analyses to identify the explanatory mechanisms underlying these results, and used the resulting insights to develop an expanded, team-level theory of the effects of formal hierarchical differentiation. Our second, study, a field study of 135 clinical nursing shifts in five mid-sized hospitals suggested that the alternative hierarchies in our taxonomy are present in some organizational teams, and offered preliminary support for our expanded theory and modeling results.

Implications for Theory

Our two complementary studies make several important theoretical contributions. Most significantly, we contribute to the literature on hierarchy by identifying alternative formal hierarchical structures in addition to the pyramid and leaderless team. In so doing, we push scholars to move beyond comparing the effects of the presence or steepness of pyramid-shaped hierarchies and towards exploring fundamentally different structures. Study 1 suggests that the failure to consider such structures in the past may have been a serious oversight. Indeed, at low perspective taking accuracy, the best performing structure was neither the pyramid nor the leaderless team, but the inverse pyramid, while the diamond and rectangle structures were most robust to variations in perspective taking accuracy. Neither the inverse pyramid, the diamond, nor the rectangle has received significant scholarly attention, but such attention seems warranted.

Our results also challenge functional theories of hierarchy (e.g., Magee & Galinsky, 2008), which propose that pyramid-shaped formal hierarchies predominate due to their effectiveness. We find that pyramids do not yield optimal performance under all task conditions, which suggests there may be other reasons for the prevalence of such hierarchies. For instance, teams may reflexively adopt pyramid shaped hierarchies not because they are more effective than alternatives, but because they are seen as more legitimate[4]. If this is true, institutional explanations of formal hierarchical structures in teams that focus on social, normative, or coercive pressures (DiMaggio & Powell, 1983; Meyer & Rowan, 1977) may provide a valuable complement to the existing functional accounts.

Additionally, prior research suggests hierarchy's effects are task-contingent (e.g., Anderson & Brown, 2010; Greer et al., 2018), but has not made consistent predictions about the nature of these contingencies or provided a cohesive theoretical explanation of their effects. The agent-based modeling we conducted in Study 1 forced us to engage in cross-level theorizing (Hackman, 2003) by articulating how teams' task work influences the behavior of individual members, and revealed how team-level outcomes emerge through members' interactions. As part of our modeling work, we proposed that the task-related boundary conditions identified by

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[4] We are indebted to an anonymous reviewer for suggesting this possibility.

previous research can be understood based on their effect on team members' perspective taking accuracy. Our modeling results enabled us to make a directional prediction concerning this effect, which was supported in Study 2 with regards to task variety.

Finally, we contribute to theories of power by exploring power dynamics in a team setting. Much of the research on the psychological consequences of power has focused either on single actors or on dyads, and the team-level consequences of different configurations of power are only beginning to be explored. We shed new light on how the power imbalances created by formal hierarchical differentiation influence team dynamics. Based on our modeling results, we theorize that formal hierarchy skewness plays a critical role in influencing team members' perspective taking motivation. To date, formal hierarchical structures have not been described in terms of skewness, but it may be useful to do so going forward. The model also explained how task-driven differences in team member perspective taking accuracy determine whether members' perspective taking motivation is beneficial or harmful for team performance. Specifically, the increased perspective taking motivation engendered by positively skewed hierarchies (such as the pyramid) is beneficial under conditions of high accuracy, because it increases the likelihood that members will act in a manner that is inconsistent with their own preferences to benefit the group as a whole. However, when task conditions make it difficult for members to accurately gauge one another's preferences, the enhanced perspective taking motivation created by positively skewed hierarchies increases the likelihood that team members will mistakenly pursue a course of action that does not benefit the team due to a misperception of high-ranking team members' desires. In such task conditions, negatively skewed formal hierarchies (such as the inverse pyramid) yield optimal performance.

Implications for Practice

The present research has clear and immediate implications for organizations. In particular, our findings suggest that organizations should be very thoughtful about how they distribute job titles and formal authority among the members of work teams. Although a pyramid-shaped formal hierarchy may be preferable for teams whose members work on routine, repetitive tasks, teams who work on ambiguous, or unusual tasks, or who face other conditions that might reduce perspective taking accuracy might be well-served to consider implementing a negatively skewed structure such as the inverse pyramid. If it is unclear how easy it will be for team members to assess one another's views and preferences accurately, teams might adopt a diamond-shaped or rectangular formal hierarchy, in which formal authority is distributed equally or normally amongst members. Our results suggest this type of structure is more robust to different levels of team member perspective taking accuracy.

Our findings may also be useful to managers seeking to evaluate the effectiveness of a team's formal hierarchy. As revealed by the agent-based modeling results, some structures lead to more variation in performance during the early stages of interaction, but then settle into more stable and higher performing trends over time. Understanding typical performance patterns over time could help managers avoid overreacting to early performance variations and benefit from the longer-term performance gains generated by alternative hierarchical structures.

We acknowledge that there are challenges associated with implementing the alternative hierarchies in our taxonomy. In many organizations, salaries are determined in large part by formal hierarchical level. For such firms, appointing many team members to positions high in formal authority may prove prohibitively expensive. However, the clinical nursing shifts in Study 2 offer clues as to how alternative structures might be implemented. In the shifts with formal hierarchies that most closely approximated the inverse pyramid, the senior members frequently did not occupy the very highest hierarchical levels. Instead, the highest-ranking members of these shifts were nurses with a moderate level of formal authority who were supported by a few techs or nursing assistants with very low authority. Similarly, a diamond-shaped structure, in which most members have an intermediate level of formal authority, may only be marginally more expensive to implement than a pyramid. Organizations might also change their pay structures to reduce the cost of implementing top-heavy formal hierarchies.

Limitations and Research Possibilities

Future research might build upon our efforts in several ways. We developed our agent-based model based on the assumption that the ideal outcome for teams is that which best satisfies the collective needs and interests of all members. The value of incorporating multiple team members' perspectives in decision-making is supported by research on the wisdom of crowds (Clemen, 1989; Suroweicki, 2004), which suggests that a collaborative approach to decision-making often improves accuracy (Larrick & Soll, 2006; for reviews see Armstrong, 2001; Clemen, 1989). Our assumption was also appropriate in light of our empirical context for Study 2, as clinical nursing shifts are thought to perform better to the extent that they incorporate insights from members at all hierarchical levels (Richardson & Storr, 2010). However, for some teams, other outcomes may be more important than reaching a team optimum solution, and future research could fruitfully explore the utility of the hierarchical structures in our taxonomy across an expanded set of effectiveness criteria.

We also chose to focus on formal hierarchies and their corresponding power differentials. Although this choice was motivated by the literature, other types of hierarchies – most notably status hierarchies – also form in teams and organizations. Research suggests that the effects of status on team members' behavior and cognition may be different from that of power. For instance, Blader and colleagues (Blader & Chen, 2012; Blader et al., 2016) found that whereas higher levels of power reduced perspective taking and the equitable treatment of others, higher levels of status increased these outcomes. Thus, our results may not generalize to all types of hierarchies, and exploring the implications of the alternative structures in our taxonomy across additional bases of hierarchical differentiation would be extremely valuable.

Moreover, we focused on perspective taking motivation as the primary mechanism through which formal hierarchical differentiation influences team effectiveness. This focus is supported by the substantial body of research showing that hierarchy creates power imbalances that affect team members' willingness to consider each other's views and preferences (e.g., Blader et al., 2016; Fiske, 1992; Gruenfeld et al., 2006; Keltner et al., 2003). However, the literature also identifies other mechanisms (e.g., internal rivalries or power struggles, Kilduff, Elfenbein, & Staw, 2010; Menon & Blount, 2003) through which formal hierarchies might affect team outcomes. Considering these alternative pathways lies outside the scope of the present study, but is an important next step.

Another noteworthy aspect of both our studies is that they featured team members who were fairly uniform in terms of demographics. To isolate the effects of formal hierarchical differentiation, team members in our agent-based model were identical in all respects except for their level of formal authority. Similarly, the clinical nursing shifts in Study 2 were primarily composed of Caucasian females. Thus, we did not consider the potential for subgroups to form within teams based on demographic differences (e.g., Carton & Cummings, 2012; Lau & Murnighan, 1998; Thatcher & Patel, 2012), or how these subgroups might influence team dynamics and performance. Similarly, we did not consider how team members' individual differences (e.g., extraversion, communal orientation) might interact with their level of formal authority to influence their perspective taking motivation and team optimal behavior (Kraus, Chen, & Keltner, 2011). We view these as compelling avenues for further investigation.

Finally, Study 2 is subject to several limitations. Most significantly, the shift-level sample size was modest, which restricted our statistical power. A post-hoc power analysis carried out using G*Power v. 3.1.9.4 (Faul, Erdfelder, Lang, & Buchner, 2007) revealed that the central analysis we presented had a power of .77, slightly below the recommended .80 threshold (Cohen, 1988). Although the fact that our Study 2 findings are consistent with those in Study 1 increases our confidence in their validity, due to the limited power we were unable to test a more complex model that included our theorized mediators. Additionally, although we collected our measures of task variety and patient care at different times, they came from the same source. Because our central effect is an interaction, our measure of formal hierarchical differentiation was collected from archival sources, and our task variety and patient care variables were created by aggregating the responses of multiple team members, our results are less susceptible to the problems associated with common method bias (Podsakoff, MacKenzie, & Podsakoff, 2012). Nevertheless, it is important for future research to verify our findings with alternative research designs. For instance, a laboratory or field experiment (Grant & Wall, 2009) might enable scholars to focus on comparisons that they find particularly relevant by directly manipulating teams' formal hierarchical structures, to assess team members' perspective taking motivation and accuracy directly, and to consider the relative importance of multiple explanatory mechanisms.

The limitations of the present research should be considered in light of its considerable strengths. The agent-based model in Study 1 enabled us to compare the performance of many different formal hierarchical structures, including several previously unexplored structures, and develop new theory explaining their effects. Such an undertaking would have been difficult if not impossible with the research methods more commonly used by organizational scholars. Our confirmatory field study (Study 2) addressed many of the model's limitations and provided preliminary support for a key modeling prediction (Burton & Obel, 2011). However, Study 2 was only possible due to the more sophisticated, team-level theorizing enabled by our modeling results. We are confident that the two studies reported here significantly advance our understanding of alternative formal hierarchical structures beyond the pyramid, as well as the implications for team performance and management strategies.

CONCLUSION

Organizations' reliance on pyramid-shaped formal hierarchies is older than the pyramids themselves. It is long past time to consider other approaches. We hope that this article will serve as a launching pad for future studies aimed at helping organizations find new and better solutions to the foundational problem of how to distribute formal authority amongst their members.

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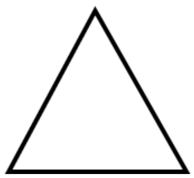
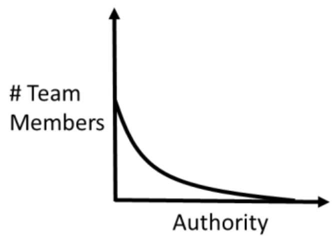
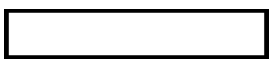
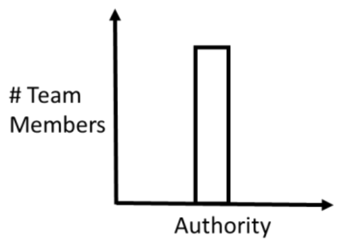
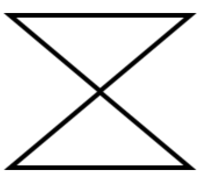
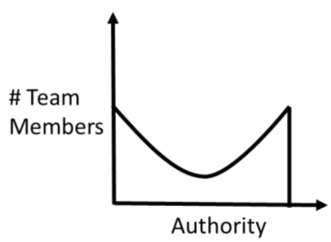
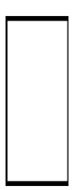
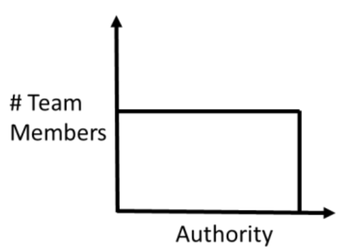
TABLE 1:

A Taxonomy of Formal Hierarchical Structures

Formal Hierarchical Structure	*Authority Distribution*	*Description and Example*
 Pyramid	 Positively Skewed	A small number of formal leaders, most members in supporting roles. *E.g., Traditional work teams (Cohen & Bailey, 1997)*
 Leaderless Team	 Constant	No formal leaders, all team members with equivalent formal authority. *E.g., Self-managing teams (Manz & Sims, 1987; Barker, 1993; Langfred, 2004)*
 Hourglass	 Bimodal	Members evenly distributed between high and low formal authority, few mid-level roles. *E.g., Surgical teams (Sexton et al., 2000)*
 Rectangle	 Uniform	An equal number of team members at each level of the formal hierarchy. *E.g., Rowing teams (Yu et al., 2019); some academic research teams*

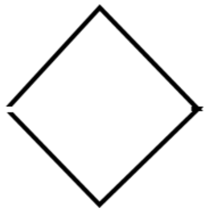
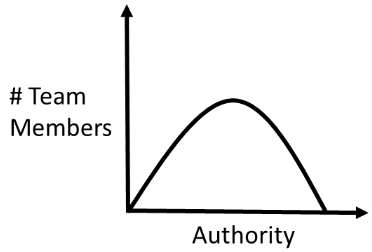
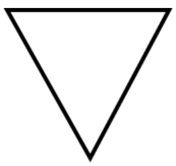
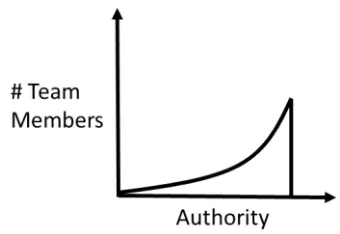
Formal Hierarchical Structure	*Authority Distribution*	*Description and Example*
 Diamond	 Normal	Most members have moderate formal authority, with a few formal leaders and a few low-ranking support staff. *E.g., Some hospital nursing shifts (Duffield et al., 2007*)
 Inverse Pyramid	 Negatively Skewed	Most members have high formal authority, only a few low-ranking members. *E.g., Advisory or support teams (Kauffman & Seidman, 1970)*

TABLE 2

Study 1: Key Decision Rules and Parameters for Agent-Based Model

Decision Rule	**Definition**	**Operationalization**
Perspective taking motivation	Team members' motivation to comprehend how others think and feel, and incorporate those perspectives into their own decision making	Members consider utilities of others with formal authority ≥ own formal authority - social identification adjustment when voting Members' weight own utility by own formal authority in voting decision
Social Identification Adjustment	Team members' perception of oneness or belongingness with the team	Set at zero and updates over time based on member optimum and team decision Team decision = member optimum: social identification adjustment + 1 Team decision ≠ member optimum: Social identification adjustment - 1 (team selects team optimum), OR social identification adjustment reset to zero, next vote = own members' own utility (team does not select team optimum)
Model Parameter	**Definition**	**Operationalization**
Formal Hierarchical Differentiation	Distribution of formal authority across team members	Teams assigned one of six structures from Table 1. Members assigned one of five levels of formal authority based on team structure.
Perspective taking Accuracy (Task Contingencies)	Team members' ability to accurately assess one another's views and preferences	Perceived utility values adjusted by an error term set by researchers at ± 3.33 (low accuracy) or 0 (high accuracy)

TABLE 3

Study 2: Formal Hierarchical Structures of Clinical Nursing Shifts

Formal Hierarchical Structure	*Participated*	*Included in Analyses*	*M Patient Care (SD)*
Pyramid	61	31	4.26 (.31)
Hourglass	3	1	4.67
Rectangle	7	1	4.42
Leaderless Team	16	4	4.47 (.49)
Diamond	23	14	4.44 (.24)
Inverse Pyramid	25	17	4.41 (.30)
Total	135	68	4.36 (.31)

TABLE 4

Study 2: Descriptive Statistics and Intercorrelations

	M	*SD*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1. Gender	.89	.15									
2. Education	3.64	.52	.00								
3. Organizational tenure	10.61	5.45	.09	.34**							
4. Shift size	16.99	11.90	.06	.06	-.16						
5. *M* Authority	1.89	.34	.03	.55**	.33**	-.18					
6. Conflict	2.13	.39	.15	-.08	.16	-.15	-.07	(.96)			
7. Formal hierarchy skewness	1.37	1.11	.02	.13	-.17	-.09	.35**	-.10			
8. Task variety	4.11	.31	.25*	.22†	.31*	.08	-.07	.14	-.05	(.75)	
9. Patient care	4.36	.31	.03	.31**	.42**	-.05	.14	-.33**	-.16	.36**	(.92)

n = 67-68 shifts due to missing data. Gender coded % female. Education coded 1 – High school, 2 – Vocational/certification program, 3 – Some college, 4 – College degree, 5 – Master's degree, 6 – M.D. / Ph.D. Values in parentheses are Revelle's omega total estimates of internal consistency reliability.

† $p < .10$
* $p < .05$
** $p < .01$

TABLE 5

Study 2: Results of Linear Mixed Models Predicting Patient Care

	Model 1		Model 2		Model 3	
Variable	*b*	*SE*	*b*	*SE*	*b*	*SE*
Intercept	4.33**	.05	4.32**	.06	4.32**	.06
Gender	.09	.22	-.06	.21	-.14	.21
Education	.10	.08	.03	.08	-.01	.07
Organizational tenure	.02**	.01	.02*	.01	.02*	.01
Shift size	-.00	.00	-.00	.00	-.00	.00
M Authority	-.14	.13	.04	.14	.08	.13
Conflict	-.34**	.08	-.37**	.08	-.36**	.07
Formal hierarchy skewness			-.04	.03	-.04	.03
Task variety			.31**	.11	.26*	.10
Formal hierarchy skewness x Task variety					-.15*	.06
Psuedo-R^2	.37		.45		.49	

n = 68 shifts. Gender coded % female. Education coded 1 – High school, 2 – Vocational/certification program, 3 – Some college, 4 – College degree, 5 – Master’s degree, 6 – M.D./Ph.D. Formal hierarchical structure coded 0 – Pyramid, 1 – Inverse Pyramid.

* $p < .05$

** $p < .01$

FIGURE 1

Study 1: Overview of Decision Rules for Agent-Based Model

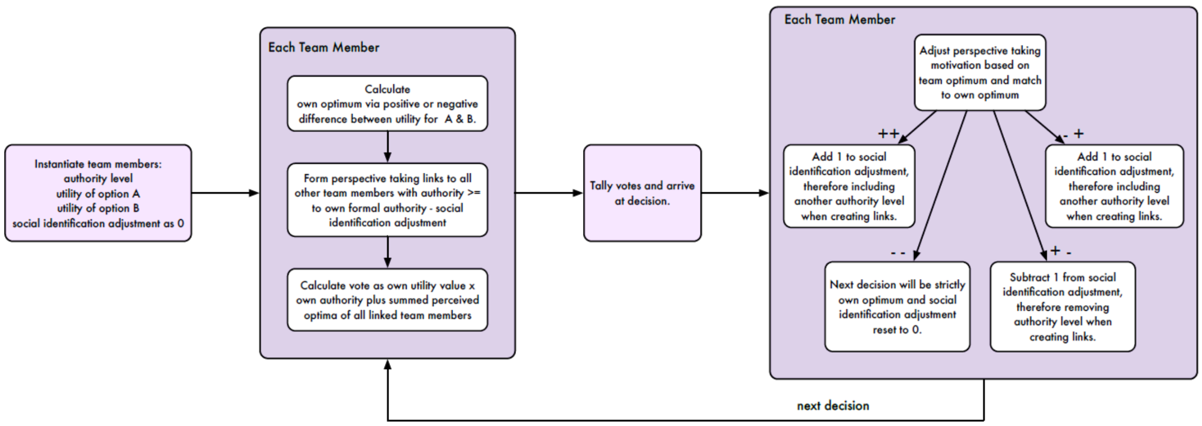


FIGURE 2:

Study 1: Team Optimal Decision Rates of Formal Hierarchical Structures at High and Low Member Perspective Taking Accuracy

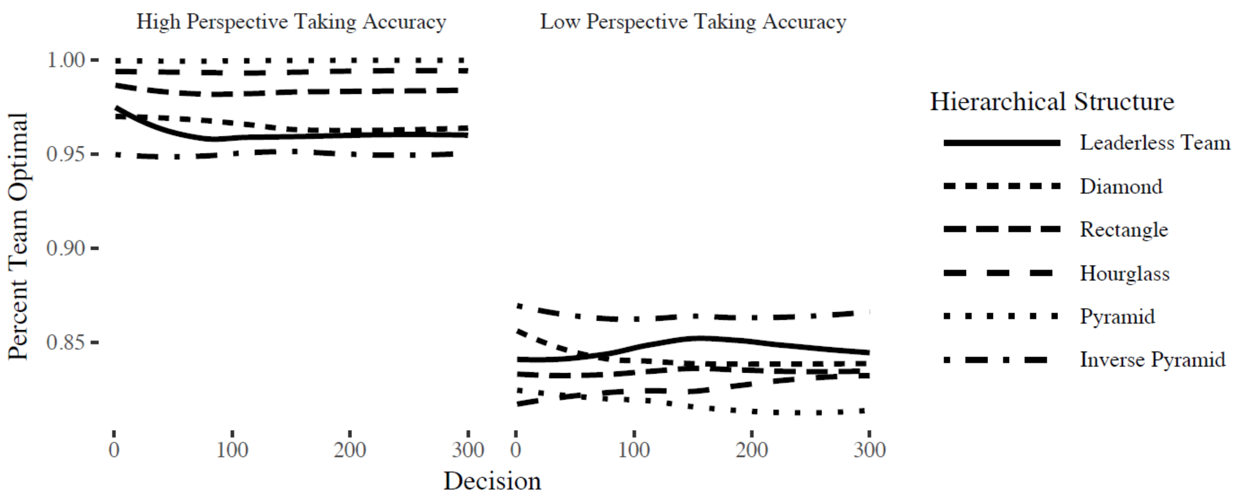


FIGURE 3:

Study 1: Team Optimal Decision Rates of Pyramid, Inverse Pyramid, and Leaderless Team Structures by Team Size and Perspective Taking Accuracy

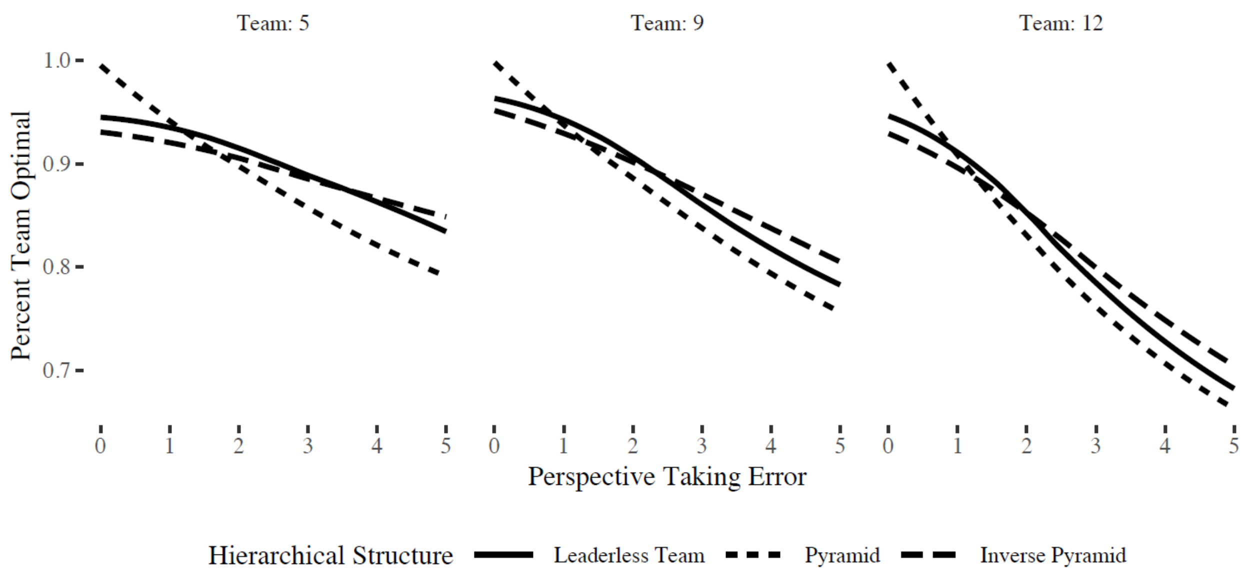
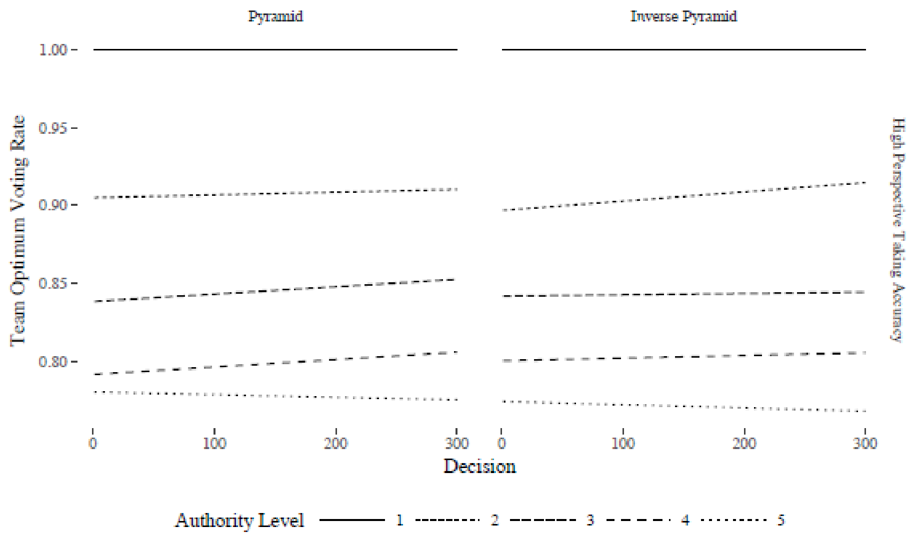


FIGURE 4:

Study 1: Member Team Optimum Voting Rate by Formal Authority in Pyramid and Inverse Pyramid Structures



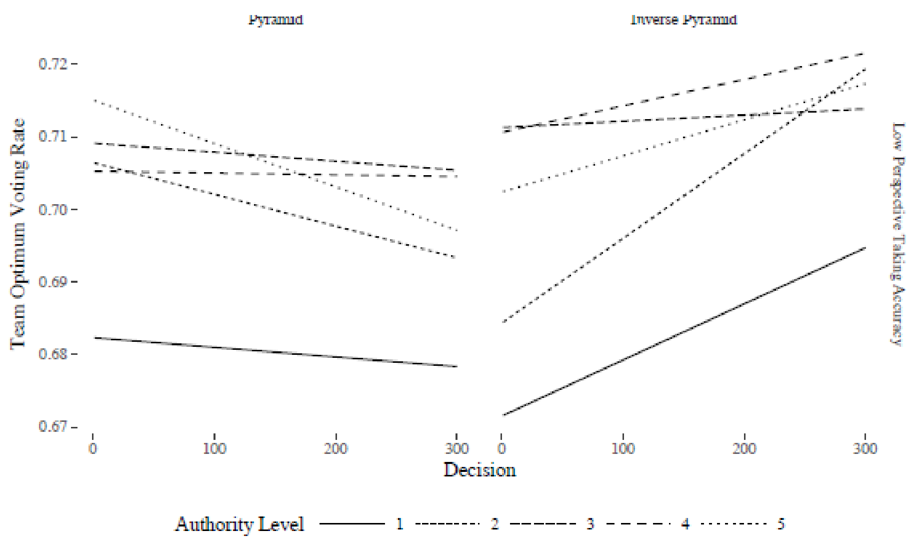


FIGURE 5:

Study 1: Expanded Theoretical Model of Formal Hierarchical Differentiation and Team Performance

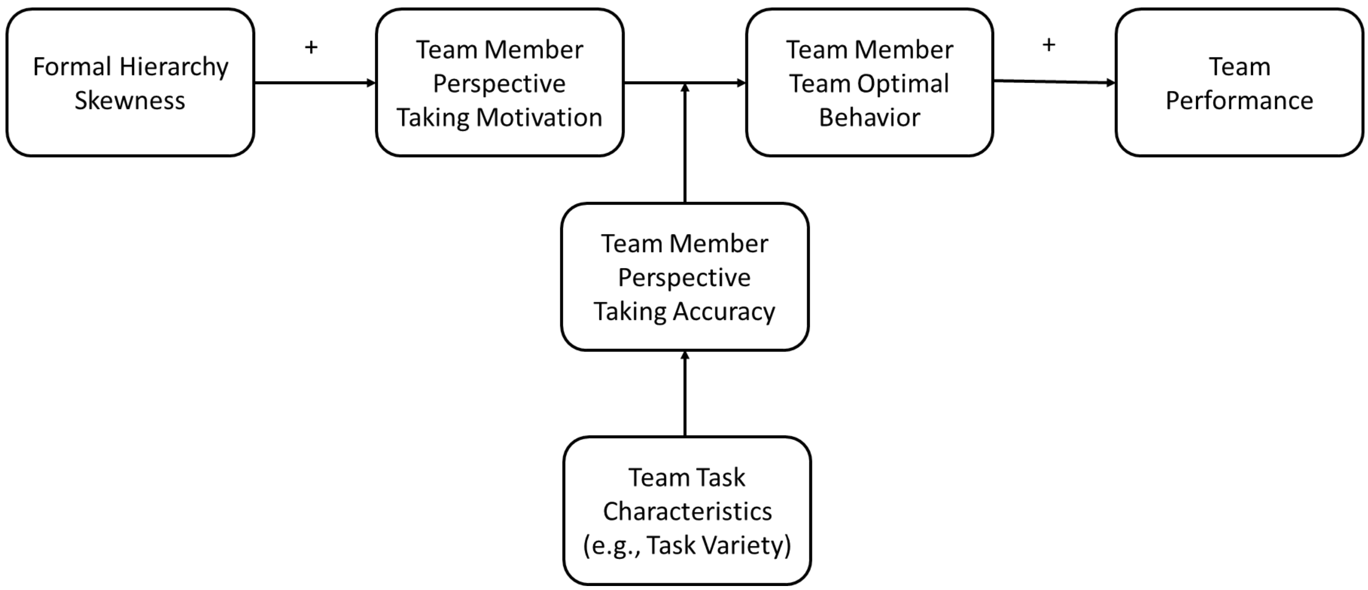
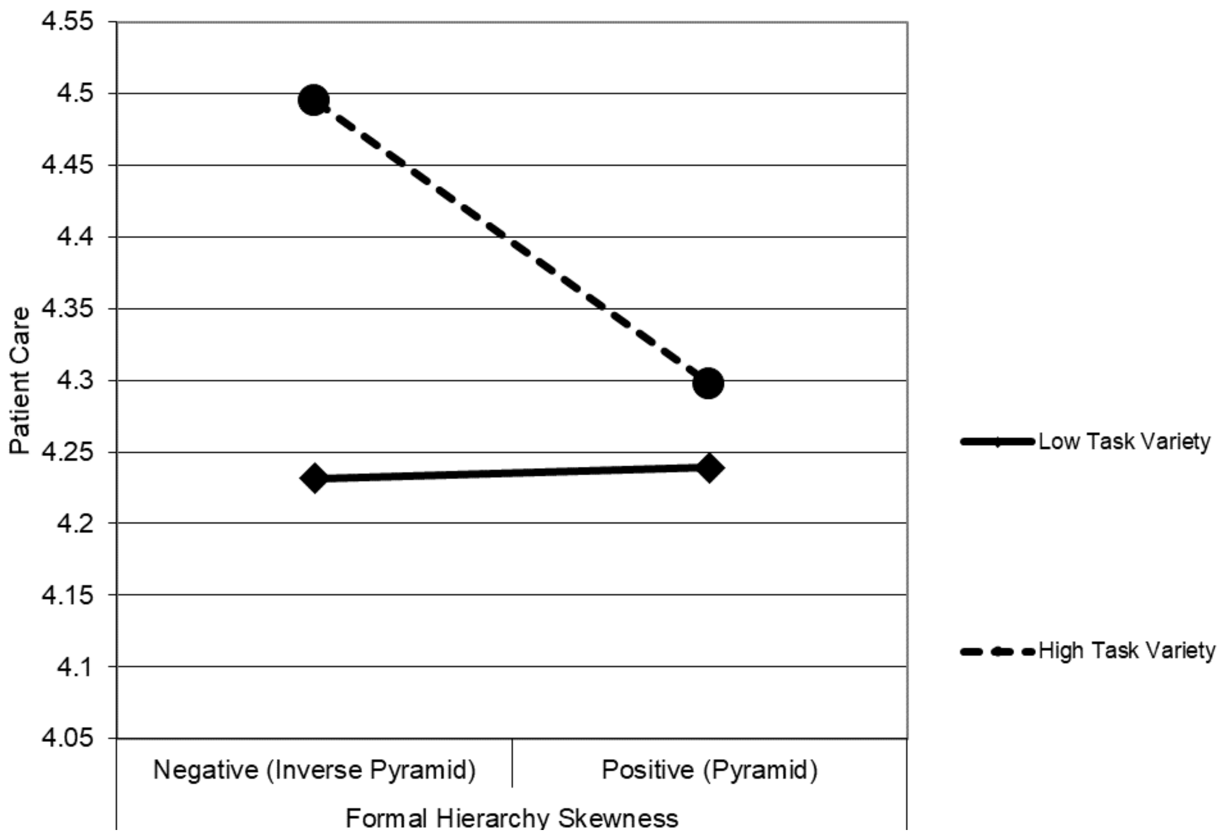


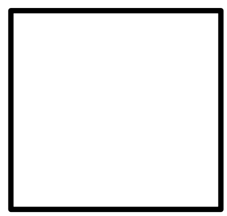
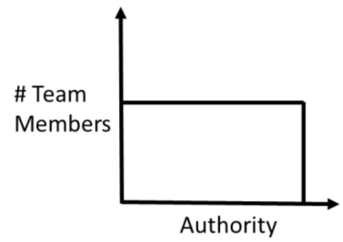
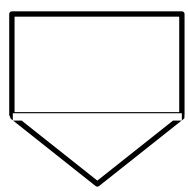
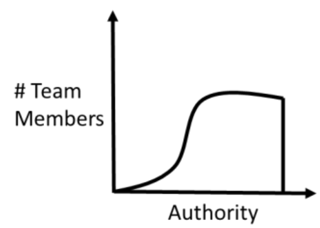
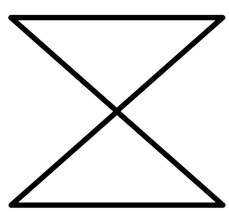
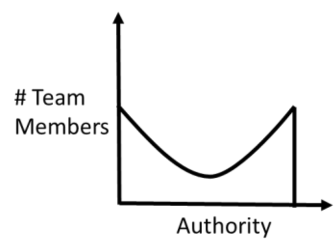
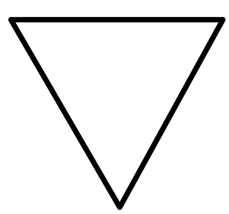
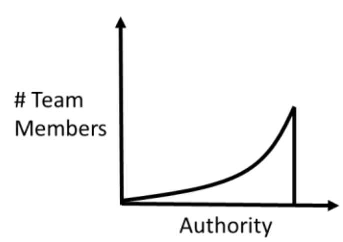
FIGURE 6:

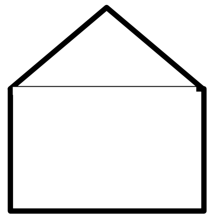
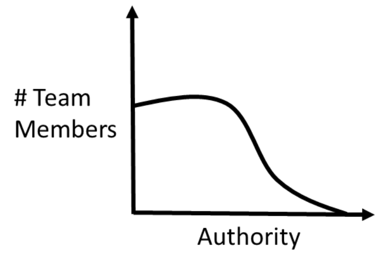
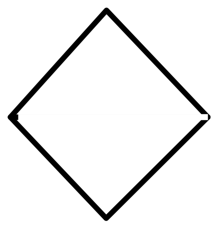
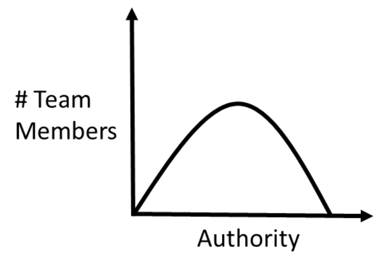
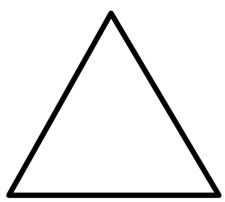
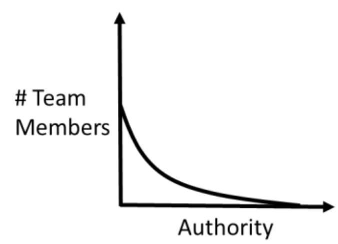
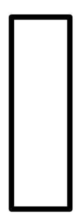
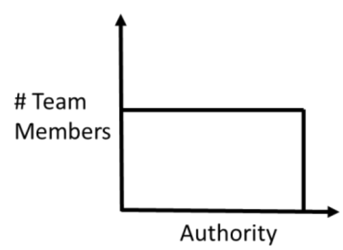
Study 2: Formal Hierarchy Skewness and Task Variety Predicting Patient Care



Appendix

Initial Taxonomy of Formal Hierarchical Structures and Underlying Authority Distributions

Authority Concentration	*Conceptual Representation (Hierarchical Structure)*	*Mathematical Representation (Authority Distribution)*
High Wide, Medium Wide, Low Wide	 Square	 Uniform
High Wide, Medium Wide, Low Narrow	 Inverse Pentagon	 Uniform/Negatively Skewed
High Wide, Medium Narrow, Low Wide	 Hourglass	 Bimodal
High Wide, Medium Narrow, Low Narrow	 Inverse Pyramid	 Negatively Skewed

Authority Concentration	*Conceptual Representation (Hierarchical Structure)*	*Mathematical Representation (Authority Distribution)*
High Narrow, Medium Wide, Low Wide	 Pentagon	 Uniform/Positively Skewed
High Narrow, Medium Wide, Low Narrow	 Diamond	 Normal
High Narrow, Medium Narrow, Low Wide	 Pyramid	 Positively Skewed
High Narrow, Mid Narrow, Low Narrow	 Rectangle	 Uniform

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