TOP MANAGEMENT TEAM DIVERSITY AND FIRM PERFORMANCE: EXAMINING THE ROLE OF COGNITIONS

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TOP MANAGEMENT TEAM DIVERSITY AND FIRM PERFORMANCE: EXAMINING THE ROLE OF COGNITIONS

Demography research rarely examines the black box within which the cognitive diversity of the top management team is assumed to affect firm performance. Using data from 35 simulated firms run by a total of 159 managers attending executive education programs, the current research tested several hypotheses concerned with: a) the relationship between demographic and cognitive team diversity; and b) the reciprocal effects of diversity and firm performance. Results showed that members of high-performing teams tended to preserve multiple interpretations early in the team's life cycle, but moved toward greater clarity near the end of the life cycle. These high-performing teams, therefore, exhibited both early interpretative ambiguity and late heedful interrelating. Cognitive diversity in teams both affected and was affected by changes in firm performance. Surprisingly, there was no evidence of any effect of demographic diversity on measures of cognitive diversity.

Commenting at the fifth game of the National Basketball Association (NBA) championship series in Seattle, basketball legend, Julius Erving, remarked that the 1996 Chicago Bulls offered a glimpse of what the team of the future would look like: the 1996 Chicago Bulls were one of the most nationally and ethnically diverse teams ever assembled in the NBA. The Bulls' lineup consisted of the best white and African American players from three continents: Europe, Australia, and America.

The increasing diversity in the NBA is only one instance of a larger trend. The work force throughout the developed world is becoming more diverse, reflecting changing demographics within nation states (Johnston and Packer 1987) and migrations of peoples across national borders (Hambrick, Korn, Fredrickson and Ferry 1989, p.33).

This growing demographic diversity may be accompanied by a parallel increase in attitudinal or cognitive diversity, according to the literature on organizational demography. Within this literature, the assumption is commonly made that demographic variation signals variation in underlying and invisible cognitive processes. From this perspective, diversity may have important effects on team and organizational performance.

Thus, the growing diversity of the workforce underscores three questions of theoretical and practical importance. First, how does demographic diversity affect cognitive diversity? Second, what are the effects of team cognitive diversity on performance? Third, is there a reciprocal effect of firm performance on team cognitive diversity? We explored these questions in a simulation of top management team decision making.

LITERATURE REVIEW

The victory of the Chicago Bulls in the NBA championships notwithstanding, the relationship between team diversity and outcomes remains unclear, partly because there are numerous possible aspects of diversity that can be investigated. Lawrence (1997, pp. 5-6) suggested that diversity can be studied across at least four different categories of variables: visible demographic attributes (such as gender); relational attributes (such as organizational tenure); status attributes (such as marital status); and personal attributes (such as personal beliefs and perceptions). In practice, research has tended to ignore the category of personal beliefs and perceptions, a neglect this paper attempts to remedy.

Researchers have pointed to both the costs and benefits of increased diversity in teams. Top management team demographic diversity has been shown to predict turnover rates (Jackson, Brett, Sessa, Cooper, Julin and Peyronnin 1991, Wiersema and Bird 1993); increased levels of work group diversity have been associated with lower psychological attachment to the organization (Tsui, Egan, and O'Reilly 1992) and less frequent communication (Zenger and Lawrence 1989). But diversity has also been hailed as a competitive advantage because minority views "can stimulate consideration of non-obvious alternatives in task groups" (Cox and Blake 1991, p. 50); and heterogenous teams have been shown to be more creative than homogenous teams (Hambrick, Cho and Chen 1996, Triandis, Hall and Ewen 1965).

The discrepancy in the research literature concerning the effects of team diversity on organizational functioning reflects two different approaches. The demographic approach studies cognitive diversity in terms of proxy variables such as gender, age, organizational tenure, ethnicity, and nationality (see Pfeffer 1983 for a review). The emphasis is on directly measurable

attributes of individuals. The cognitive approach studies cognitive diversity through direct questionnaire measures of attitudinal and normative differences between individuals who may be homogenous on demographic indicators (e.g., Nemeth 1986). Thus, cognitive diversity in this literature refers to variability concerning relatively unobservable attributes such as attitudes, values, and beliefs. Although both approaches claim to be studying cognitive diversity, they measure very different attributes of individuals.

According to demography researchers, the reason to gather demographic rather than cognitive data when examining the consequences of diversity is that, "mental processes... are more difficult to access and reliably measure" (Pfeffer 1983, p. 351). Demographic variables are argued to be more objective, to yield more parsimonious explanations of organizational phenomenon, and to be more easily submitted to testing than cognitive variables (Hambrick and Mason 1984, Pfeffer 1983, p. 352, Wiersema and Bantel 1992, p. 94).

Although the demographic approach seems to offer a short-cut to studying the effects of diversity on organizational outcomes, a careful reading of the demography literature reveals a disjunction between theory and research. As noted by Lawrence (1997, p. 2), organizational demographers hypothesize "various subjective concepts that explain significant association between demographic predictors and outcomes....However, by invoking Pfeffer's justification, researchers usually leave the concepts unmeasured and the hypotheses untested. As a result, subjective concepts and their relationships within research models have become the 'black box' of organizational demography." Demographic variables are often treated as convenient proxies for cognitive ones in predicting team outcomes.

The use of demographic variables as surrogates for cognitive ones is premised on the assumption that demographic variables predict and explain variation in intervening cognitive variables (Hambrick and Mason 1984, Pfeffer 1983, p. 350). Thus, for example, Michel and Hambrick (1992) suggested that a common background in terms of tenure in the top management team or functional specialization "contributes to the development of common schemata among team members" (p.18). Similarly, Tsui, Egan, and O'Reilly (1992) argued that individuals use demographic categories such as age and race to define psychological groups that reinforce self-identity; and Wiersema and Bantel (1992, p. 112) argued that demographic categories reflect individuals' cognitive bases. Team demographic diversity, measured over such visibly salient variables as age, gender and race, has been assumed to be an accurate reflection of how much the team shares a common set of attitudes, values, and norms.

Researchers have tended to avoid specifying precise relationships between diversity on particular demographic variables and diversity on particular cognitive variables in favor of general assertions that the more demographically diverse the team, the more members will tend to see the world differently, with this increased cognitive diversity affecting individual and firm performance (see the discussion in Lawrence 1997, p. 4). Research results on outcome variables have thrown this assumed general correspondence between demographic and cognitive diversity into some doubt, however. For example, one study found that team heterogeneity had opposite effects on performance depending on the measure of heterogeneity selected: Whereas heterogeneity of experience negatively affected performance, heterogeneity in years of education positively affected performance (Smith, Smith, Olian, Sims, O'Bannon, and Scully 1994). Another study reported that top management team tenure heterogeneity had results directly

contrary to those hypothesized (Michel and Hambrick 1992). Similarly, Tsui, Egan, and O'Reilly (1992) found, contrary to their predictions, that the larger the difference between the individual and the group on measures of organizational tenure and education, the higher the individual's intent to stay with the firm. Wiersema and Bantel (1992, p. 14) reported that: "Very little support for the heterogeneity argument emerged... heterogeneity on age, organizational tenure, and team tenure were not significantly associated with strategic change."

That these outcomes turned out to be different from predictions suggests that the link between demographic and cognitive diversity may be more complex than generally assumed by demographers. As Smith et al (1994, p. 432) summarized the results of their research: "The relationships between team demography, team process, and organizational performance are not as straightforward or as simple as scholars have previously believed." Homogeneity along demographic markers does not necessarily engender homogeneity in attitudes, beliefs or values. Thus, one of the puzzling results in the decision making literature has been the wide array of individual cognitive styles characteristic of people homogenous on demographic indicators. For example, a study of third-year elementary education majors (all females under the age of 30) from the same university revealed a strikingly wide range of attitudes toward potential job interviews. The authors suggested that idiosyncratic preferences and personality traits could produce such individual cognitive differences (Rynes and Lawler 1983). Other research has found little support for the effects of top management team demographics on firm performance, but some effects of social process variables such as communication frequency (Smith et al 1994) that may be related to cognitive variables.

THEORY AND HYPOTHESES

In the current research we examined the links between demographic diversity and cognitive diversity, and also examined how these different kinds of diversity influenced team performance. We looked at three aspects of demographic diversity: functional specialization (e.g., marketing, research and development, etc.), national origin (i.e., French, German, etc.), and age. Previous demography research has suggested that teams with high variability on these kinds of markers may have different schemata or ways of seeing the world (e.g., Michel and Hambrick 1992). For example, executives from different functional areas may view organizational problems from different perspectives (Dearborn and Simon 1958, Walker 1985, Waller, Huber and Glick 1995; but see Walsh 1988, for a dissenting view). Further, managers from different countries tend to have different frameworks for approaching a wide range of issues (Hofstede 1980, Laurent 1983, 1986). Similarly, research suggests that people of similar ages tend to view the world in general in similar terms, reflecting shared experiences and socialization (cf. Tsui, Egan, and O'Reilly, 1992, Wagner, Pfeffer, and O'Reilly 1984), with older cohorts tending toward increased intra-cohort heterogeneity on a wide variety of characteristics (Dannefer 1987). Thus, based on prior research and theory, we decided to test the hypothesis that demographic diversity on important indicators such as functional affiliation, national origin and age would predict diversity over a wide range of attitudes, beliefs, and values relevant to organizational decision-making. We recognize that much of the prior research we have summarized casts doubt on the predicted relationship between demographic variation and cognitive variation. Nevertheless, we thought it important to at least subject this often unstated hypothesis to a formal

test. We also recognize that there are other important demographic variables, such as tenure, that are not studied in the current research.

Hypothesis 1: The higher the demographic diversity of the top management team, the higher the cognitive diversity of the team's decision-making processes.

Despite their differences over how best to examine the impact of diversity on organizational outcomes, both the proponents of the demographic approach and those of the cognitive approach agree that cognitive diversity is related to organizational outcomes. There is less agreement, however, on what the precise form of this relationship may be. We draw on a sensemaking perspective (Weick 1979, 1995) to argue that cognitive diversity can be either a blessing or a curse, depending upon the specific type of cognition involved.

First, from a sensemaking perspective (Weick 1979, 1995), the preservation of multiple interpretations in teams is critical for registering complex environments. Weick reasons that for the detailed registering necessary for successfully coping with a complex, equivocal environment, the variety within the organization must match the variety outside it (1979, p. 190; cf. Ashby 1952). Interpretive ambiguity within the top management team preserves the requisite variety needed to sense and regulate the variety facing the organization. Interpretative ambiguity is defined as follows: Lack of clarity within the team concerning the degree to which team members share common attributions concerning, for example, organizational success and failure (cf. Martin 1992, pp. 133-134). Defined this way, interpretative ambiguity is a team-level construct.

It is important to note here that the interpretative ambiguity valued by Weick should be distinguished from disorganization on the one hand (i.e., teams in which everyone explicitly

disagrees with everyone else) and unanimity or groupthink on the other (i.e., teams in which everyone agrees with everyone else). Interpretative ambiguity resembles most closely that state of equivocality in which both agreement and disagreement concerning the environment are simultaneously possible allowing the same reality to be perceived by team members in different but complementary ways. As Weick (1995, p. 120) pointed out, in organizations characterized by strategic ambiguity (a concept originated by Eisenberg 1984), "people are not pressed to articulate their individual understanding" of causal connections. Thus, people act effectively together without the team as a whole ever clarifying how much interpretative ambiguity actually exists. Previous research from a sensemaking perspective has shown that teams can act effectively despite an absence of shared meanings (Donnellon, Gray and Bougon 1986) or shared goals (Bourgeois 1980). From this perspective, efforts to clarify team disagreements may damage performance. As a major study of string quartets concluded: "the more successful quartets...managed...inherent contradictions implicitly and did not try to resolve them" (Murnighan and Conlon 1991, p. 165).

Hypothesis 2: The higher the interpretative ambiguity within the top management team, the higher the firm's subsequent performance.

A completely separate issue concerns not how the team members interpret the causal connections in the external environment, but the degree to which team members perceive the same internal environment. In some teams, members will tend to have differing perceptions of how such basic processes as decision making and task structuring are accomplished. An absence of agreement concerning basic team processes is evidence of lack of team cohesion. This lack of

cohesion can significantly impair performance according to long-standing theory (Stodgill 1959) and recent research (Smith et al 1994).

Controlled conflict can, of course, be built into team processes and can aid decision making by expanding perspectives, but only to the extent that conflict remains affect-free and focused on how best to achieve objectives (Amason 1996). Executives in for-profit firms report finding conflict unpleasant and leading to low-quality decisions (Schwenk 1990), suggesting that affect-free cognitive conflict in top management teams is rare. Conflict over decision making processes and task structuring, like other conflicts, can consume resources, such as time (March and Simon 1958, pp. 149-151), and thus adversely affect performance. From a sense-making perspective, in fast moving environments, speed of decision making is critical in allowing the top management team to influence events as they are developing (Eisenhardt 1989). On balance, therefore, the research suggests a generally negative effect of disagreement over basic team processes on organizational performance.

Hypothesis 3: The higher the top management team disagreement concerning basic team processes, the lower the firm performance.

In focusing on the effects of cognitive diversity on performance, we should not lose sight of the possibility of a dynamic relationship between performance and cognition. From an enactment perspective, feedback from the environment is expected to trigger changes in cognition which in turn affect actions that help determine subsequent performance (Weick 1979). The emphasis is on reciprocal relationships between cognitive change and performance change. From an enactment perspective, top management teams help create environmental outcomes (such as successful or unsuccessful product launches) that have consequences for team cognition

and functioning. Members of top management teams that see their firms succeeding in the competitive marketplace may become increasingly homogenous in their adherence to idiosyncratic traditions according to research on the development of strong-culture organizations (Kotter and Heskett 1992). Failing performance, on the other hand, may create a sense of crisis that results in a wider range of perceptions and beliefs among top management (Kotter and Heskett 1992).

Hypothesis 4: Increases in firm performance will decrease top management team cognitive diversity.

Previous research has confirmed that team cognitive diversity does change over time, with team members' perceptions tending to coalesce around readily-identifiable norms (Jacobs and Campbell 1961, Weick and Gilfillan 1971). How might this changing cognitive diversity affect performance? The existing research concerns the decay of arbitrary norms in laboratory experiments. We were unable to find any discussion explicitly focused on the effects of changing team cognition on changes in performance. Consequently, we decided to conduct exploratory analyses on this important topic.

RESEARCH SETTING

We chose a setting in which it was possible to study the demographic and cognitive diversity of top management teams, and relate measures of diversity to performance outcomes: a business simulation involving teams of experienced managers. Organizational simulation has emerged as a valuable tool for studying complex organizational processes (e.g., Cohen, March and Olsen 1972, Masuch and LaPotin 1989). The MARKSTRAT simulation (Larreche and Gatignon 1977), in particular, is widely used for studying decision making (e.g., Hogarth and

Makridakis 1981, Lant and Montgomery 1987, Walsh, Henderson and Deighton 1988). Managers from different industries have reported that MARKSTRAT reflects the competitive environment they are familiar with, and that they take real actions in their own organizations based on their experiences in MARKSTRAT (Kinnear and Klammer 1987). The realism of the simulation has been widely recognized (e.g., Dodgson 1987, Remus 1978), and has been attributed to the game's ability to capture long-term market mechanisms (Gatignon 1987, p. 469). Further, interest by managers and other participants in the MARKSTRAT simulation is typically high (Hogarth and Makridakis 1981).

What is MARKSTRAT? Briefly, it is a game in which teams of players compete with each other in a consumer entertainment market. There are five teams, each team representing the overall strategic marketing orientation of a company. Each team, in other words, represents the top management of a company, and is responsible not only for strategic marketing, but also for coordinating production, inventory control, and research and development. The top management team plans and implements the marketing strategy of the company in the context of competition from four other companies in the same industry. Each player on each team typically has a MARKSTRAT manual (Larreche and Gatignon 1984) that describes the characteristics of the MARKSTRAT world, the ways in which to design and implement strategy in this world, and the operating instructions specific to this simulated environment.

At the beginning of the simulation, each team is responsible for marketing two brands, but part of the strategy involves modifying, withdrawing, and introducing brands. For each decision period (equivalent to one year), teams must make decisions concerning the number and types of brands, how much research and development to fund, how much production to plan for,

the advertising budget, recommended retail prices, number of salespeople, and so on. These decisions are entered into a computer which simulates the competitive environment and produces updated performance reports for each team showing units sold for each branded good, gross marketing contribution, market share, and other performance indicators.

In the current research, after a practice run designed to increase familiarity with the simulation, each team received a computer printout detailing the initial position of the organization. In the MARKSTRAT simulation, teams take over companies that are already established. The simulation was then run for 6 decision periods (each period is the equivalent of one organizational year), with each decision period lasting about two-and-a-half hours. At the end of each period, teams made alterations to the marketing mix (including pricing, sales force size, advertising budget, research and development budget, and production volume). These decisions were based on prior results given to participants as part of the game, and marketing research studies that participants could purchase out of their game budgets (see Cook 1988 for more details of MARKSRAT as a research tool).

METHOD

Sample

The sample consisted of all 159 managers (divided into 35 teams) attending selected executive development programs at a European management institute. The average age was 41 (sd = 6), with the range extending from 25 to 56. Fourteen countries were represented including 30 or more people from France, Germany, and Switzerland. Because only 3 of the participants were women, gender diversity was not measured in this study. The managers occupied a variety

of functions in European firms, including over 20 people in each of the following functions: marketing, research and development, manufacturing, and general management.

Unit of Analysis

The unit of analysis was the simulated Markstrat team to which managers were assigned. All variables were calculated at the team level. There were 35 Markstrat teams.

Measures

Questionnaires were distributed at two points in time: early in the game (at the end of the second decision period), and late in the game (at the end of the second from last decision period). These questionnaires were prepared in three languages (English, French, and German) corresponding to the language of instruction being used in the executive education programs of which the MARKSTRAT simulation formed a part. Following Hofstede's (1980, p. 34) recommendations, translations from the original English version of the questionnaire were accomplished by a person fluent in all three languages and familiar with the content matter of the document. This method avoids the often clumsy phrasing that results from back translation. The response rate for the questionnaire was 91.5% and 95% for the early and late administrations respectively.

Performance

Because MARKSTRAT is a marketing simulation, the focus of team effort is on improving marketing performance. The measures of performance, therefore, relate to the results of decision making by the top management of the marketing department, which is responsible for the overall orientation of the company to its markets (Larreche and Gatignon 1977, p. 5).

Two measures of performance were monitored by the teams throughout the game -- net marketing contribution (in dollars) and market share (percent). The net marketing contribution was the basic measure of profitability, and was defined as total revenues from sales minus expenses (cost of goods sold, research and development, inventory holding costs, etc.). The market share was expressed as a percentage of the total market captured by the focal firm in competition with the other 4 firms in its industry. Recall that each team competed with 4 other teams for market share.

In the analyses we look at these two measures of performance in different ways. To assess how well firms were doing early in the simulation, we assessed **Early Net Marketing Contribution Change** as the net marketing contribution at the start of the second period divided by the net marketing contribution at the start of the game. This measure was greater than one for firms that improved their performance during the first period, and less than one for firms that suffered performances decreases as a result of decisions made during the first period. We also examined **Final Market Share** and the **Cumulative Net Marketing Contribution** for each firm. These were the market share and profitability results at the end of the simulation. To measure performance increase and decrease over the course of the game, we looked at **Market Share Change**, measured as the percent change in market share for each firm from early in the game (end of second period) until the end of the game.

Control variables

In MARKSTRAT, teams take over existing firms, and these firms have different starting profiles. Five firms make up each MARKSTRAT world, and of these five in the current simulation, two firms had relatively disadvantaged starting positions whereas the other three

firms had relatively advantaged starting positions. Thus, we controlled for whether the team took over an advantaged or disadvantaged firm by classifying firms into two groups: advantaged and disadvantaged. The managers attending these short executive programs were assigned to teams by the instructors and had not been in prior classes together.

We controlled for size because the size of teams varied between 3 and 5 people.

Cognitive diversity

Six questionnaire items comprised the raw data for team-level cognitive diversity measures. These single-item questionnaire measures were based on the questions used by Zucker (1977) to measure cognitive variability in an institutionalization context. Like Zucker, we asked the managers to indicate (on 7 point scales) their perceptions of group processes.

First, we assessed perceptions of role specialization in the team. As Berger and Luckmann (1967, p. 74) have emphasized, "the construction of role typologies is a necessary correlate of the institutionalization of conduct." Before team members can function as an organization, it may be necessary to agree among themselves on a division of labor. Managers were asked to indicate approximately how specialized the members of the MARKSTRAT organization were, with the scale anchored with the phrases "No person has a specialized role to play" and "Each person has a specialized role to play."

The second item related to the distribution of power in the organization. An important aspect of consensus in organizations concerns the taken-for-grantedness of authority relations. The higher the consensus, the more difficult it becomes to challenge the existing order of things (cf. Garfinkel 1967). Managers were asked to estimate how easy it would be to challenge the decision making power of the dominant members. The scale was anchored with the phrases

"Very easy to challenge decision making power of dominant members" and "Very hard to challenge decision making power of dominant members."

Third, to measure agreement about the causes of performance, we asked team members the following question: "How much agreement was there in your MARKSTRAT organization about the causes of your market share results during the last decision period?" The scale was anchored with the phrases "Everybody stuck to a different explanation" and "All members agreed." The greater the variation in members' responses to this question, the more interpretative ambiguity the team was assumed to exhibit with respect to attributions about past performance. If everybody in the team responded identically, then this was taken as evidence of team consensus about the level of agreement in the team.

Fourth, we assessed the degree to which each participant perceived team decision making to be an habitual, routine, taken-for-granted activity. Berger and Luckmann (1967, p. 54) have pointed out that "Habitualization makes it unnecessary for each situation to be defined anew, step by step." To the extent that decision making in the team was perceived by a participant to be part of a high consensus, institutionalized process, then the participant should perceive the decision making process as relatively easy rather than difficult. Participants were requested to: "Think about how difficult or easy it is for your MARKSTRAT organization to make decisions." The scale was anchored with the phrases "Very difficult to make decisions" and "Very easy to make decisions."

The fifth item concerned each individual's agreement with team decision making. The more consensus in the team over decisions, the more each individual should feel normative pressure to agree with the team decision (Zucker 1977, p. 737). We asked participants to "Think

about your participation in the organization's decisions in the last session. Did you feel you should agree with the decisions reached by your MARKSTRAT organization?" The scale was anchored with the phrases "No -- I felt that I could disagree" and "Yes -- I felt that I should agree."

Finally, increasing consensus was expected to increase the taken-for-grantedness of organizational procedures, thus making it more difficult to imagine ways to improve effectiveness. Each manager was asked whether there were some obvious ways in which the MARKSTRAT organization could be run more effectively, with the end points of the 7 point scale anchored with the phrases: "Yes -- there are many ways to increase effectiveness" and "No -- there are few ways to increase effectiveness."

The team-level coefficient of variation scores on these six variables represented our measures of cognitive diversity.

Demographic diversity

We measured three demographic diversity variables -- national heterogeneity, functional heterogeneity, and age heterogeneity -- that prior literature suggested as important.

ANALYSIS

All variables were measured at the team level of analysis. The performance variables were measures of how well each team had performed. The diversity variables were calculated as heterogeneity within each organizational team as follows.

For the two categorical demographic variables (nationality heterogeneity and functional heterogeneity), Blau's (1977) index of heterogeneity was computed (see Jackson et al, 1991, for

the formula and a recent example of its use). This index can vary from 0 (indicating all team members are the same) to a high of 1 (indicating all team members are different).

The other diversity measures (including age heterogeneity and the cognitive diversity measures) were calculated for each team as the coefficient of variation (i.e., standard deviation divided by the mean). This is a scale-invariant measure judged to be superior in its psychometric properties to other measures such as the standard deviation (Allison 1978).

The effects of diversity on performance were investigated using ordinary least squares multiple regression. The adjusted R-squared statistic is reported in all tables in order to adjust the variance explained for the number of parameters in the models. We also used multivariate analysis of variance (MANOVA) to assess the effects of independent variables on multiple dependent variables.

RESULTS

Table 1 about here

Table 1 shows the effects of advantageous and disadvantageous starting position on the performance and cognitive diversity measures. Note that the firms we labelled as advantaged did in fact have significantly higher performance than firms we labelled as disadvantaged. The effects of an advantageous starting position significantly influenced early net marketing contribution change ($t = -5.734$, $p < .001$), cumulative net marketing contribution ($t = - 4.897$, $p < .001$), and final market share ($t = -3.456$, $p < .05$). There was no significant difference between

advantaged and disadvantaged firms in how well they improved their market share over the course of the game.

Table 2 about here

Table 2 shows the descriptive statistics for the variables in this study, including minimum and maximum values. Recall that the demographic and cognitive diversity variables represent variation within each team. This table shows that teams differed greatly both with respect to how much market share was gained and lost, as well with respect to final success or failure in the industry. The diversity measures show considerable mean differences in variation across teams.

Table 3 about here

Table 3 presents the correlations between the variables. Of interest is the significant negative correlation between team size and national heterogeneity, reflecting the fact that some of the most heterogenous groups happened to contain the least people. The six measures of cognitive diversity were relatively independent of each other: Of the correlations between these six variables, only one was significant at the .05 level (decision pressure and decision difficulty, r = .36). None of the demographic diversity measures were significantly correlated with the cognitive diversity measures.

The first hypothesis, which suggested that demographic diversity would predict cognitive diversity was not supported. There were no significant relationships between the demographic diversity variables and cognitive diversity in any of the regressions we ran. Evidently teams that were heterogenous on age, functional background, or national origin were no more cognitively diverse early in the game or late in the game than teams less heterogenous on these demographic indicators.

Table 4 about here

The second hypothesis suggested a positive effect of interpretative ambiguity on subsequent firm performance. The relevant results are displayed in Table 4, where we see that the overall models explain significant amounts of variance in performance, ranging from 21 to 54 percent. The results in Table 4 (model 3) show support for hypothesis 2: The greater the interpretative ambiguity early in the game, the higher the final performance in terms of both market share (beta = .272, $p < .05$) and profits (beta = 361.318, $p < .05$). Because these two performance dependent variables were highly correlated, we conducted a MANOVA test to see if there was an overall effect of interpretative ambiguity on the two dependent variables taken as a set. There was a marginally significant overall effect of interpretative ambiguity ($F = 2.69$, df = 2, 22, $p < .10$).

The results for interpretative ambiguity controlled for both the significant effects of starting position and possible effects of three types of demographic diversity on performance. Looking at the demographic diversity variables, functioning as controls in the regressions, we see

that there was a significant effect of age heterogeneity on performance: the higher the variation in age, the higher the performance of the firm (MANOVA test: $F = 3.47$, $df = 2, 22$, $p < .05$).

The third hypothesis suggested that team disagreement concerning basic team processes would reduce firm performance. The results in Table 4 show little support for this hypothesis. Over a range of five cognitive diversity variables related to team processes (specialization, power, decision difficulty, decision pressure, effectiveness) only the decision difficulty variable was marginally significant in predicting performance: the greater the variation in team members' perceptions of decision-making difficulty, the lower performance of the firm in terms of market share (beta = -.232, $p < .10$) and profits (beta = -.275.043, $p < .10$). But this marginal effect was not evident when the two dependent variables were considered as a set (MANOVA test: $F = 1.76$, $df = 2, 22$, ns).

Table 5 about here

Hypothesis 4 suggested that increases in firm performance would lead to decreases in top management team cognitive diversity. Table 5 provides two tests of this hypothesis, using an early measure of performance change and a later measure of performance change. Note that in these analyses we omit the starting position control variable because of its high multi-collinearity with one of the independent variables, early net marketing contribution change. Starting position had no significant effect on any of the dependent variables and no overall effect on the dependent variables taken as a set. Its inclusion in the analyses weakened model fit, but had no effect on the pattern of results that we report.

First, Table 5 shows the effect of changes in performance in the early stages of the game on cognitive diversity. Contrary to the hypothesis, this effect is generally positive. A MANOVA test on the six cognitive diversity variables taken as a group shows a significantly positive effect of early improvement in profits (operationalized as Early Net Marketing Contribution Change) on cognitive diversity ($F = 4.60$, $df = 6, 26$, $p < .01$). The one exception to this generally positive relationship between performance change and cognitive diversity change was the interpretative ambiguity variable. As profits increased in the early stages in the game, the interpretative ambiguity of the top management team decreased (beta = -.217, $p < .10$).

During the remainder of the simulation, however, the predicted negative relationship between performance change and top management team cognitive diversity change was in evidence. As Table 5 shows, five of the six cognitive diversity variables were negatively related to overall market share increase. A MANOVA test on the effect of change in market share over the course of the simulation on the six cognitive diversity dependent variables taken as a set was significant ($F = 3.06$, $df = 6, 26$, $p < .05$). However, only the interpretative ambiguity measure reached significance in the univariate tests: The greater the increase in market share, the more the team tended to reduce interpretative ambiguity (beta = -1.412, $p < .01$).

Table 6 about here

Table 6 details the effects of cognitive diversity change on the final performance of firms in the simulation. These were exploratory analyses for which we formulated no hypotheses. The models explained significant amounts of variance, with adjusted r-squares ranging from 45 to 58

percent. Immediately apparent is the continued importance of starting position: Firms that started advantageously concluded the game with significantly higher market share and revenues than firms that started the game in disadvantageous positions.

Looking at the cognitive diversity measures, we see that increasing interpretative ambiguity was associated with low final performance both in terms of market share and profits. A MANOVA analysis, taking the two performance measures as a set, confirmed a significant effect for interpretative ambiguity ($F = 6.36$, $df = 2, 25$, $p < .01$). A closer investigation of this phenomenon showed that all 6 firms with market share changes 1 standard deviation below the mean showed increases in interpretative ambiguity over the course of the simulation. For those 19 firms that showed positive market share gains, 13 of them showed a reduction in interpretative ambiguity.

DISCUSSION

The results cast doubt on the thesis that teams composed of people of diverse nationality, functional background, or age are likely to be diverse in terms of their cognitive processes. There was no evidence for an effect of demographic diversity on measures of cognitive diversity in these decision making teams.

One possible reason why demographic diversity may have failed to affect measures of cognitive diversity relates to the competitive nature of the MARKSTRAT business simulation. To the extent that people within a team are driven by the goal of maximizing performance relative to other teams, the social group origins of team members may fade in importance. A team, such as the 1996 championship Chicago Bulls basketball team, characterized by national, ethnic, and age heterogeneity, may be held together in part by the fierce inter-team rivalry of

professional sports. Previous research and theory has suggested that superordinate goals can bring people from diverse social groups together (Sherif, Harvey, White, Hood and Sherif 1961; see the discussion in Coser 1956). Thus team members may have focused on their competitive goals rather than on their national, functional, or age differences. This suggests that the effects of demographic diversity on cognitive diversity may be minimized for teams facing external competition.

It is also possible that the effects of demographic diversity on cognitive diversity may take more time to appear than was available in this simulation. People may initially strive to harmonize their thinking with that of their new teammates. But after this initial honeymoon period, people may become more comfortable relying on thought-patterns characteristic of particular age-cohorts, national cultures, or functional specialties. (See, however, a contrary argument in Pelled 1996, p. 623).

Another possibility is that demography does have effects on cognitive diversity, but that these effects are specific to certain types of demography and certain types of cognitive diversity not studied in this research.

The hypotheses concerning the effects of cognitive diversity on firm performance received mixed support. There was little evidence that team disagreement concerning basic team processes (such as work structuring and decision making) had any effect on firm performance.

Interpretative ambiguity emerged as the key cognitive diversity measure that differentiated successful versus unsuccessful teams. Interpretative ambiguity among team members early in the game predicted overall performance of the firms. An exploratory analysis showed that teams that ended the simulation with high performance tended to reduce the degree

of ambiguity over the course of the simulation, even though they tended to start out with high interpretative ambiguity. Exactly the opposite pattern was observed for low-performing teams. Thus, successful and unsuccessful teams showed quite different patterns of ambiguity management over the course of the simulation.

Gersick (1990, p. 103), in her qualitative analysis of two project groups, suggested that the successful team tended in the early meetings to operate with implicit understandings that were not openly discussed or challenged. In our terms, this absence of explicit discussion tends to preserve high levels of interpretative ambiguity. Her observations of a less successful group showed the members spending considerable time during the early meetings to explicitly outline their varying positions on important issues, thus, in our terms, reducing interpretative ambiguity. Gersick suggested that all groups tend to undergo predictable transitions in the course of their life-cycles, but that groups' trajectories can vary. Our research suggests that the team's management of interpretative ambiguity over the course of the team's life-cycle can be a factor affecting performance outcomes. Future work should examine in greater detail the time-related effects of team diversity.

The only demographic diversity measure to affect overall performance was age heterogeneity. Paradoxically, the greater the diversity of team members' ages, the better the teams performed. This result is strikingly different from previous research that has reported generally negative effects of age diversity in groups (see the review in Milliken and Martins 1996), although there have been few if any direct tests of top management age diversity on firm performance. Recent research by Hambrick, Cho and Chen (1996) found positive results of top management team heterogeneity on firm performance, although they did not measure age

heterogeneity. Their results from the real world paralleled the results from this simulation in showing that top management team heterogeneity had significantly positive effects both on growth in market share and growth in profits. According to Hambrick et al (1996, p. 665), the heterogenous team has a broad potential behavioral repertoire and is able to "conceive and launch actions on many fronts." From this perspective, demographic heterogeneity may well complement rather than determine cognitive heterogeneity. Age diversity does matter, but not because it predicts cognitive diversity. Teams heterogenous on demographic variables may be better able to build on the diverse experience base of the team to validate diverse cognitions, and thus take advantage of innovative suggestions.

Not only did diversity affect performance; there was also a reciprocal effect of performance change on changes in team cognitive diversity. In the latter part of the simulation, teams with improving performance tended to exhibit decreasing diversity across the range of cognitive variables, suggesting a growing consensus among the members of high-performing teams.

The current research is limited in looking at a relatively small number of highly competitive teams engaged in a simulation of real-world decision making. Fortunately, the realism of the MARKSTRAT world is high (Dodgson 1987, Remus 1978), and the players in the current research were all practicing managers from the private sector familiar with decision processes in competitive firms. We were able to collect realistic performance data separately from our questionnaire measures, thereby eliminating the problems of common method variance. Future research can extend the preliminary results in this study by examining decision making

teams in the field rather than in the laboratory. One arena for which both demographic and performance data is readily available is professional sports.

In using the results in this paper as a basis for further research, attention should be paid to the relatively small number of teams relative to the large number of regressors. The statistical tests, in particular, may be unstable given the low power of the study. We have tried to correct for this problem by reporting adjusted r-squares, by testing hypotheses with more than one dependent variable, and by the extensive use of multivariate tests. Thus, the significant effects of interpretative ambiguity on performance show up whether the performance dependent variable is market share or profitability, and whether the tests are univariate or multivariate.

We also recognize that our reliance on one-item measures of cognitive diversity violates arguments concerning the importance of reliable, multimethod measurements of individual dispositions and cognitions (e.g., Block, 1977). Because of this methodological shortcoming, this study=s assessments of the effects of cognitive diversity are likely to comprise preliminary tests of the hypotheses.

One of the major tasks of management is to maintain within teams rich possibilities for sensemaking while at the same time promoting coordinated work. In the current research we saw that successful teams tended to allow interpretative ambiguity to flourish in the early stages of their life-cycle, but to exhibit more interpretative clarity in the later stages. This cycle of ambiguity and clarity may represent one dynamic solution to the twin problems of impoverished sensemaking on the one hand and uncoordinated activity on the other. How can teams foster both equivocality and mutual understanding? The answer from the present research is to take

advantage of the natural cycle of work: in the beginning let ambiguity flourish; in the end, strive for heedful interrelating.

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Table 1 Effects of Firm Starting Position

	Starting Position		
Variables	Advantageous	Disadvantageous	t
	Performance Means (and Standard Deviations)		
Early Net Marketing	2.04	1.55	-5.73***
Contribution Change	(.27)	(.23)	

Final Market Share	0.23	.15	-3.46**
	(.10)	(.04)	
Cumulative Net Marketing Contribution	339.09 (122.68)	159.76 (73.77)	-4.90***
Market Share Change	-.01 (.088)	.02 (.04)	1.31

Note: n = 35 firms.

* p < .05; ** p < .01; *** p < .001.

Table 2 Descriptive Statistics

Variables	Mean	S.D.	Median	Minimum	Maximum
1. Market Share Change	-.00	.07	.01	-.18	.23
2. Early NMC Change[a]	1.84	.35	1.92	1.23	2.93
3. Final Market Share	.20	.09	.20	.04	.50
4. CNMC[b]	267.36	137.40	242.40	56.60	606.00
5. Size	4.23	.73	4	3	5
6. Starting Position				1	2
Demographic Diversity					
7. National	.37	.28	.38	0	.75
8. Functional	.63	.12	.64	.32	.80
9. Age	.13	.07	.10	.03	.35
Cognitive Diversity					
10. Specialization	.43	.26	.41	0	.99
11. Power	.38	.16	.39	.10	.66
13. Ambiguity	.16	.13	.14	0	.49
14. Decision Difficulty	.25	.13	.26	0	.50
15. Decision Pressure	.36	.21	.35	0	.84
16. Effectiveness	.37	.19	.39	0	.87

Note: n = 35 firms.

[a] Net marketing contribution change.

[b] Cumulative net marketing contribution.

Table 3 Intercorrelations Among Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Market Share Change														
2. Early NMC Change[a]	-.21													
3. Final Market Share	.67***	.38*												
4. CNMC[b]	.37*	.56***	.88***											
5. Size	-.00	-.21	-.04	-.15										
6. Starting Position	-.31	.72***	.53**	.67***	.06									
Demographic Diversity														
7. National	.34*	-.05	.16	.15	-.40*	-.10								
8. Functional	.07	-.30	-.01	-.15	.31	-.05	-.24							
9. Age	.30	-.17	.25	.16	-.08	-.07	.21	-.09						
Cognitive Diversity														
10. Specialization	.19	-.12	.16	.13	-.05	.08	.23	-.05	.19					
11. Power	-.01	-.18	.01	.03	-.10	-.03	.13	.09	.24	.11				
12. Ambiguity	.25	.27	.44**	.50**	-.22	.26	.18	-.28	-.07	-.11	-.02			
13. Decision Difficulty	.05	-.31+	-.24	-.33+	.37	-.32+	-.09	.28	.16	-.13	.07	-.09		
14. Decision Pressure	.19	-.28	-.12	-.31+	.16	-.39*	.13	.13	.20	-.12	.06	-.10	.36*	
15. Effectiveness	.29+	-.42*	.06	.00	.03	-.26	.16	.26	-.04	.03	.31+	.05	.33+	.11

Note: n = 35 firms; [a] Net marketing contribution change; [b] Cumulative net marketing contribution.

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

Table 4 Effects of Diversity on Final Organizational Performance

	Final Market Share			Cum. Net Marketing Contribution		
Variables	1	2	3	1	2	3
Size	.01	.01	.02	.74	7.84	24.69
	(.02)	(.02)	(.02)	(27.02)	(26.93)	(25.60)
Starting Position	.10**	.07+	.08*	195.45***	142.25**	157.10**
	(.03)	(.03)	(.03)	(36.22)	(42.49)	(40.02)
National Heterogeneity	.08		.05	97.81		67.48
	(.05)		(.05)	(69.77)		(67.87)
Functional Heterogeneity	.05		.11	-54.13		19.76
	(.118)		(.122)	(151.46)		(151.54)
Age Heterogeneity	.39+		.53*	420.26		640.32*
	(.20)		(.21)	(256.80)		(255.13)
Cognitive Diversity Variables						
Specialization		.03	-.01		10.21	-42.47
		(.06)	(.05)		(68.61)	(66.14)
Power		.04	-.02		91.97	10.60
		(.10)	(.10)		(128.77)	(121.77)
Ambiguity		.26+	.27*		387.83*	361.32*
		(.13)	(.13)		(161.73)	(155.77)
Decision Difficulty		-.17	-.23+		-211.02	-275.04+
		(.13)	(.12)		(164.00)	(154.86)
Decision Pressure		.05	.01		-16.29	-62.82
		(.08)	(.07)		(93.37)	(87.21)
Effectiveness		.08	.10		113.85	155.38
		(.09)	(.09)		(108.17)	(106.11)
Overall Model F	3.30*	2.12+	2.61*	6.55***	4.59**	4.70***
Adj. R^2	.25	.21	.34	.45	.46	.54
Root MSE	.08	.08	.08	101.96	101.17	92.72
Degrees of Freedom	5,29	8,26	11,23	5,29	8,26	11,23

Note: n = 35 firms; the table shows unstandardized betas (with standard errors in parentheses).

+ $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Table 5 Effects of Performance Change on Team Cognitive Diversity Change

	Cognitive Diversity Change						
	Special-ization	Power	Ambiguity	Decision Difficulty	Decision Pressure	Effectiveness	MANOVA[a] (Wilks' Lamda)
Size	.04	.05	-0.02	-.02	-.01	.03	
	(.06)	(.05)	(.04)	(.04)	(.07)	(.05)	
Early Net Marketing	.23^{+}	.05	-0.22^{+}	.13	.18	.20^{+}	0.49, F = 4.60**
Contribution Change	(.12)	(.10)	(.09)	(.08)	(.14)	(.10)	
Market Share Change	-0.79	.62	-1.41**	-0.02	-0.59	-0.56	0.59, F = 3.06*
	(.57)	(.47)	(.41)	(.37)	(.65)	(.45)	
Overall Model F	2.33^{+}	.97	5.09**	1.33	1.11	2.38^{+}	
Adjusted R^2	.10	.00	.27	.03	.01	.11	
Root MSE	.24	.19	.17	.15	.27	.19	
Degrees of Freedom	3,31	3,31	3,31	3,31	3,31	3,31	6, 26

Note. n = 35 firms. The table shows unstandardized betas (with standard errors in parentheses).

[a] The MANOVA indicates whether the 6 dependent variables taken as a set are significantly affected by an independent variable.

$^{+}$ $p < .10$, * $p < .05$, ** $p < .01$.

Table 6 Effects of Cognitive Diversity Change on Final Performance

	Final Market Share		Cumulative Net Marketing Contribution	
Size	-0.00	(.02)	-20.35	(21.62)
Starting Position	-0.07*	(.03)	148.51***	(35.81)
Change in Cognitive Diversity				
Specialization	-.01	(.06)	23.07	(72.02)
Power	.11	(.06)	113.75	(81.81)
Ambiguity	-0.24**	(.07)	-303.76**	(89.57)
Decision Difficulty	.14+	(.08)	127.24	(108.26)
Decision Pressure	-0.03	(.05)	9.13	(61.59)
Effectiveness	-0.10	(.06)	-145.07+	(82.25)
Overall Model F		4.54*		6.86***
Adj. R^2	.45		.58	
Root MSE	.07		89.07	
DF	8,26		8,26	

Note: n = 35 firms; the table shows unstandardized betas (with standard errors in parentheses).

+ $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.