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**THE IMPACT OF TIME PERSPECTIVE ON
KNOWLEDGE CREATION IN TEAMS**

**CEO PUBLICATION
T 00-6 (379)**

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**May 2000
(Revised April 2001)**

This publication was previously titled "Time Flies Like an Arrow: Tracing Antecedents and Consequences of Temporal Elements of Organizational Culture"

The authors wish to thank Allen Bluedorn, David Finegold, Robert Giambatista, Tatiana Kostova, anonymous Academy of Management reviewers, and anonymous AMR reviewers for their helpful comments on this paper. An earlier version of this paper was presented at the 1999 Academy of Management Meetings, International Management Division, Chicago, IL.

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ABSTRACT

This paper focuses on the impact of individuals' time perspectives on team knowledge creation. Various configurations of time perspective among team members are likely to exert significant but unacknowledged influences on teams' knowledge creation efforts.

Configurations of time perspective within teams may affect key processes that help determine (1) the speed of knowledge creation, and (2) the novelty of knowledge created. Implications for existing theory, future research, and practitioners in team-based contexts are included.

(74 words)

Surrounded by highly competitive Internet-speed environments, many organizations are increasingly relying on autonomous cross-functional teams -- often referred to as knowledge work teams (KWTs) -- to rapidly create new knowledge for use in new products or processes (Eisenhardt & Tabrizi, 1995; Mohrman, Gailbraith, & Lawler, 1998). KWTs are typically quickly formed and disbanded in order to facilitate the flexibility and timeliness of new knowledge creation in organizations (Brown & Eisenhardt, 1998). Team performance under these conditions can be critical for organizational outcomes ranging from new product development (Sethi, 2000) to customer response time (Weimer, Knill, Manji, & Beckert, 1992). In this paradigm, the timing of knowledge creation is central to organizational success (Gleick, 1999). Deepening our understanding in this area is critical if we are to comprehend management in A New Time.

While there are countless aspects of knowledge creation and time that are important for inquiry, this paper asks the question: How might the speed of knowledge creation and the novelty of knowledge created in KWTs be affected by team members' *perspectives* of time? We focus on *knowledge creation* in recognition of its consequences for overall firm effectiveness (Schendel, 1996; Spender & Grant, 1996), organizational renewal (Dougherty, 1992a), and knowledge work (Nonaka, 1994). We train particular attention on (1) the *speed* of knowledge creation in teams due to the competitive and time-starved environments within which many knowledge-creating teams work (Perlow, 1999), and (2) the *novelty* of knowledge created, given the tensions and trade-offs between the creation of knowledge that generates incremental as opposed to breakthrough advances (March, 1991; Tushman & Romanelli, 1985). Additionally, we focus here on KWTs that are *ad-hoc or temporary teams*, as opposed to work groups or more permanent teams, due to their unique and increasingly central role in knowledge creation for

organizations facing turbulent environments. Such KWTs may not experience longevity sufficient to develop a substantial amount of their own norms, rules, or habitual patterns of interaction that might limit the influences of factors such as time perspective on team outcomes (e.g. Gersick & Hackman, 1990; Goodman & Leyden, 1991).

Time perspective is the overall past, present, or future orientation held by an individual (Jones, 1988). It is a stable individual difference that may result from national cultural trends, child rearing, education, religion, socialization, or life experiences (Hall, 1983; Kluckhohn & Strodtbeck, 1961; Zimbardo & Boyd, 1999). Three central reasons guide our focus on time perspective as a link to understanding knowledge creation in KWTs. First, time is an ever-present performance factor for most organizations (Ancona & Chong, 1996; Bluedorn & Denhardt, 1988; Bluedorn, 1998). For example, within project teams, different project management techniques can speed new product development (Rosenau & Moran, 1993) and reduce the time needed for project completion (Eisenhardt, 1989). However, individuals in project teams that are struggling to perform tasks within strict time limits could differ substantially in how they react to task pacing mechanisms such as deadlines or milestones. These differences may stem from the time perspectives held by individual team members (Bird, 1992). According to Jones:

“[P]eople and groups differ in real and meaningful ways with respect to their time perspectives... Misunderstandings occur when intention and action are judged, by different participants, on different temporal scales. Values are attached to these scales. *The differences in temporal perspective often go unrecognized by the participants*” (1988: 27, emphasis added).

Thus, amid the struggle in knowledge work teams to quickly create innovative knowledge, the combination of time perspectives among team members may be the source of an underlying, and

perhaps unidentified, process loss. Understanding more about these combinations may help increase the probability of successful team outcomes.

The second reason for our focus on time perspective involves existing time-oriented theories and research. Much of the work in groups research involving time assumes a future-oriented approach to time, as deadlines are assumed to be equal motivators for all study participants (cf. Gersick, 1988, 1989; Lim & Murnighan, 1994; Parks & Cowlin, 1995; Waller, Zellmer-Bruhn, & Giambatista, 2000). Similarly, some organization theories assume a future-oriented time perspective in general. For example, goal setting theory (Locke & Latham, 1990) and prospect theory (Tversky & Kahneman, 1986) assume a fundamental orientation toward achieving future goals, even though many individuals hold no such orientation (Jones, 1988; Levine, 1997; Zimbardo & Boyd, 1999). What we believe we know about the impact of time and timing in organizations and teams may not apply in contexts that mix people holding similar or different time perspectives. Paralleling previous work suggesting a far-reaching impact of the time scales or intervals used in organizational theories (Zaheer, Albert, & Zaheer, 1999), the framework we present here suggests that the assumptions made by researchers regarding time perspective create important boundary conditions that should be identified.

Finally, based on our review of the organizational literature, the effect of placing individuals who may hold very similar or very different perspectives of time into teams, and then asking those teams to quickly and collaboratively create innovative knowledge, is vastly underexplored (see Ancona & Chong, 1996; Bluedorn & Denhardt, 1988; McGrath, 1988: 10). This topic is given even greater import by the apparent shift in the basis for competitive success in many industries from one of structural advantage, such as country or industry position, to one of *time* advantage – for example, cycle times, time to market, and turn-around times (Tyre,

Perlow, Staudenmayer, & Wasson, 1996). Indeed, KWTs that are unable to manage issues regarding time perspectives are likely to pay a significant penalty regarding the speed and novelty of their collaborative knowledge work. They may miss critical deadlines or windows of market opportunity, for example, or create incremental advances when novel or breakthrough innovations are needed.

To address the issues described above, we introduce a theoretical framework that illustrates how the configuration of time perspectives among members of knowledge work teams may affect the speed of the knowledge creation process and the novelty of knowledge created within such teams. We present propositions linked to the framework, and close with a discussion of future research and implications for existing theory and managerial practice.

LITERATURE REVIEW

Time Perspective

Individuals may hold past, present, or future time perspectives (Hall, 1983; Jones, 1988; Lewin, 1951; Levine, West, & Reis, 1980; Zimbardo & Boyd, 1999). These time perspectives are cognitive frames “used in encoding, storing, and recalling experienced events, as well as in forming expectations, goals, contingencies, and imaginative scenarios” (Zimbardo & Boyd, 1999: 1272-1273). Much research performed over many years and across many fields has investigated both the measurement and effects of time perspectives on individual attitudes and behaviors (cf. Bird & Jordan, 1987; Cottle, 1976; Nuttin, 1985; Rappaport, 1990).

Recent work by Zimbardo and Boyd (1999) describing a multi-study program of research on time perspective details the basic characteristics of past, present, and future time perspectives.¹ Their work in developing and validating a time perspective measurement

¹ Zimbardo and Boyd (1999) identified two other perspectives, Past-Negative and Present-Fatalistic; we focus here on the three above due to their centrality in the time perspective literature and implications for knowledge creation.

instrument suggests that individuals with a past time perspective hold strong, warm, and even sentimental feelings about the past. In contrast, individuals with a present time perspective hold hedonistic, risk-taking, impulsive attitudes toward time and life. Finally, individuals with a future time perspective are focused on achievement and “striving for future goals and rewards” (Zimbardo & Boyd, 1999: 1275). These basic time perspectives were highly correlated with subjects’ reported behaviors. For instance, past time perspective individuals tended to act in ways characterized as “better safe than sorry”, taking fewer risks in their personal lives. Present time perspective individuals were typically unclear about their future goals and engaged in more risky behaviors regarding personal relationships and life management behaviors. Finally, future time perspective individuals were more likely than their counterparts to make “to-do” lists, use a day planner, and balance their checkbooks.

Overall, the work summarized by Zimbardo and Boyd (1999) indicates that (1) the habitual emphasis on one of the three temporal perspectives creates a stable cognitive temporal “bias”, and (2) these time perspective biases are correlated with related behaviors. For example, homeless adults with a more present time perspective were more likely than other adults to satisfy present needs and obtain temporary housing, while homeless adults with a more future time perspective experienced a shorter duration of homelessness and were more likely to focus on future goals by enrolling in school (Epel, Bandura, & Zimbardo, 1999). Research also indicates a positive relationship between present time perspective and the presumably-hedonistic pleasures of alcohol, drug, and tobacco use (Keough, Zimbardo, & Boyd, 1999). Overall, while this area of research helps clarify the definitions of past, present, and future time perspectives, it does not postulate behaviors or outcomes among team members in organizations.

Other relevant research on time perspectives has focused more specifically on the effects of time perspectives on individual behaviors in organizations. Perhaps due to the importance of planning in organizations, the connection between planning and achievement motivation (Nuttin, 1985), or the value placed on goal- and future-oriented behavior by Western society, much of this research has focused mainly on effects of present versus future time perspectives. For example, Das (1987) found that strategic planners holding a “near future” time perspective, as opposed to those with a “distant future” perspective, preferred to make plans involving shorter planning horizons. They also perceived a higher level of consensus among organizational participants regarding planning objectives and horizons. Similarly, Bird (1992) suggests that time perspective, as an individual difference, affects the future-oriented “temporal brackets” used by entrepreneurs to plan new ventures. These brackets “refer to expectations for when a process or event will begin and how long it will take to complete” (Bird, 1992: 12), and are often formalized as business plans, PERT charts, and milestones. Weick argues that managers who use future perfect tense in thinking about planning, versus simple future tense, are able to think in more detail about the future and thus should be able to develop more comprehensive, complex, and useful plans (1979: 197-199).

In one of the few studies of time perspective at the team level of analysis, a longitudinal study of 22 top management teams conducted by West and Meyer (1998) indicated that teams with higher average future time perspectives (“futures”) engaged in more changes in strategic thinking than those with a present time perspective (“presents”). However, they also found that a higher *percentage* of team members holding future time perspectives negatively affected changes in strategic thinking, suggesting that:

“[A] balance is needed for strategic change: some ‘futures’ are necessary, but the presence of too many ‘futures’ may have adverse effects on change capability.

Teams that are composed only of ‘presents’ may not be able to make strategic adjustments because no real opportunities are identified, while teams composed primarily of ‘futures’ may not be able to coalesce on a current strategy or on any new opportunities proposed” (West & Meyer, 1998: 46).

While their study focused only on present and future time perspectives, West and Meyer’s (1998) view concerning the need for balance is echoed at the individual level of analysis by Zimbardo and Boyd, who note that a balanced time perspective encompassing elements of past, present, and future perspectives would give individuals “the mental ability to switch flexibly among time perspectives depending on task features, situational considerations, and personal resources rather than be biased toward a specific time perspective that is not adaptive across situations” (1999: 1285). While West and Meyer (1998) do not specifically address knowledge creation, based on their research regarding time perspective in established teams, it seems highly likely that the amount of balance or imbalance among time perspectives in newly-formed KWTs charged with fast knowledge creation may affect important outcomes for these teams. Research indicating that significant differences in time urgency behavior among team members affects team processes (Waller, Giambatista, & Zellmer-Bruhn, 1999) also supports this line of thinking. The next section addresses what we mean by knowledge creation, and is followed by an explanation of possible time perspective configuration effects in KWTs.

Knowledge Creation

The knowledge management literature characterizes “knowledge” as the experiences, insights, and information that form the bases upon which organizations draw conclusions (Schulz & Jobe, 1998). Organization researchers have typically divided the domain of knowledge management into two interrelated elements: knowledge creation and knowledge transfer (Appleyard, 1996; Argote, 1999; Nonaka, 1994; Szulanski, 1996). Given that “the possibility of

[knowledge transfer] arises only if local innovations are first created" (Ghoshal & Bartlett, 1988: 371), we focus here only on the knowledge creation aspect. We view knowledge creation as complete when the knowledge is deemed ready to be transferred to others inside or outside the team, as a function of contractual obligations or hierarchical authority, regardless of the perceived quality of the knowledge or the difficulties likely to be associated with such transfer.

Knowledge creation generally refers to the discovery of new knowledge or the combination of old knowledge in new ways, and is a social process (Dougherty, 1992a; Nonaka, 1994). Although the process of knowledge creation is referred to at individual, group, organizational, and interorganizational levels, it is generally acknowledged that ideas themselves are created when individuals interact (Nahapiet & Ghoshal, 1998), and often by individuals working within teams (Kogut & Zander, 1992). Individual team members' tacit knowledge can be converted to explicit knowledge through the use of metaphors, analogies, or models, and explicit knowledge can be combined through team interaction into new knowledge (Choo, 1998: 10). New knowledge can emerge, for example, when one team member's comments stimulate another team member's thinking. Conflict, too, can result in new knowledge creation when reconciliation leads to a novel solution, either through experimentation (Moorman & Miner, 1998) or via the further sharing of a team member's relevant knowledge or expertise (Argote, 1999). For the above reasons, knowledge work teams can be described as "communities of interaction" that involve "interaction between individuals [that] typically plays a critical role" in developing new ideas (Nonaka, 1994: 15).

Two important and interrelated characteristics of knowledge creation in KWTs are the *speed* with which knowledge is created, and the *novelty* of that knowledge (Sheremata, 2000). The speed of knowledge creation can have long-lasting effects on an organization's success,

particularly if knowledge creation directly impacts the speed of new product development. The speed of knowledge creation is a critical component in accurately timing new products for their appropriate “windows” of market entry opportunity (Bayus, 1997; Lilien & Yoon, 1990; Mascarenhas, 1992). Knowledge novelty, in contrast, refers to the degree to which new knowledge is incremental (i.e., builds on existing infrastructure) or breakthrough (i.e., creates the need for radically new infrastructure) in nature. Admittedly, all new knowledge has components of both, but research suggests that such knowledge is primarily incremental or breakthrough in nature (March, 1991; Tushman & Anderson, 1986). Novelty has been defined as a key component of the quality of team innovation (West & Anderson, 1996), and, similar to speed, the novelty of new knowledge can affect outcomes ranging from organizational adaptability (Dougherty, 1992a, 1992b; Eisenhardt & Tabrizi, 1995) to product market share (Lynn, Skov, & Abel, 1999). Thus, in many cases, the novelty or innovativeness of knowledge created is a critical factor in overall organizational success (Kessler & Chakrabarti, 1996, 1999).

In the following section, we argue that the configuration of time perspectives in newly-formed KWTs will affect key individual- and group-level processes and thereby influence the capacity of the team as a whole to collaboratively create innovative knowledge in an expeditious manner.

TIME PERSPECTIVE AND KNOWLEDGE CREATION WITHIN TEAMS

While previous work has not addressed the effects of time perspective configurations in teams on knowledge creation, research indicates that the relationship between the configurations of demographic differences (or heterogeneity), in general, and outcomes in teams is complex and likely to be moderated by many factors. For example, the effect of heterogeneity on team performance is sometimes positive (Hoffman & Maier, 1961; Maznevski, 1994; Triandis, Hall,

& Evans, 1965), negative (Hoffman, 1959; Triandis, Hall, & Evans, 1965; Feldman, Sam, McDonald, & Bechtel, 1980), or mixed (Bantel & Jackson, 1989; Carpenter & Fredrickson, forthcoming; Simons, 1995) based on the type of heterogeneity (e.g., heterogeneity with respect to culture, tenure, gender, or education) and the type of outcomes investigated (e.g., creativity, interpersonal relationships, efficacy).

More recent research suggests a nonlinear relationship between heterogeneity and effectiveness, with moderate heterogeneity being the most challenging type of team composition to manage. For example, using a series of three studies, Earley and Mosakowski (2000) demonstrated that during the initial interaction phase, nationality heterogeneity had a detrimental impact on team functioning. Over time, however, the impact of such heterogeneity on team performance and other team outcome variables was related in a curvilinear fashion. After forming ways to interact and communicate, highly heterogeneous teams appeared to create a common identity, and ultimately out-performed the moderately heterogeneous teams.

Importantly, this effect may be due to the *configuration* of personal characteristics in teams, as opposed to the overall level of heterogeneity. That is, in a moderately heterogeneous team, an awareness of heterogeneity may exist only if members perceive differences among themselves based on particular salient features (Lau & Murnighan, 1998; Ravlin, Thomas, & Ilsey, 2000). For example, a group containing three U.S. members and three German members is likely to break into subgroups based on this salient characteristic, even if they are similar on many other dimensions (e.g., gender, age, tenure) and thus can be considered only "moderately heterogeneous." In this example, nationality creates what Lau and Murnighan refer to as a strong "faultline," defined as "...hypothetical dividing lines that may split a group into subgroups based on one or more attributes" (1998: 328). Analogous to the geological faultlines under

tectonic plates, team faultlines arise from a combination of team member attributes, and underlie how team heterogeneity affects functioning in that the team members are aware that they are indeed heterogeneous, and take the steps necessary to form unique ways of interacting and understanding each other.

In contrast to this previous research, we argue that most KWTs charged with fast and novel knowledge creation are not intact long enough to form and benefit from unique ways of interacting and communicating. Further, time perspective is not a salient or faultline feature, but is instead a mostly-unnoticed and underlying individual difference that may affect knowledge creation processes in teams. Thus, most members of knowledge work teams are unaware that time perspective differences exist in their teams, and do not have the time necessary to build interaction or communication routines to compensate for it if they were so aware. Such a distinction is critical since much of the literature on knowledge creation suggests that heterogeneous groups are generally better than homogeneous groups at developing new knowledge (Argote, 1999; Moorman & Miner, 1997; Williams & O'Reilly, 1998). However, most of that literature has explored heterogeneity with respect to tenure, function, education, or other demographic characteristics, and has conceptualized heterogeneity in terms of a single continuum from more to less heterogeneous. Time perspective configurations, in contrast, do not simply range from more to less on a single continuum, but instead represent the relative influence of past, present, and future time perspectives in any given team. Therefore, we suggest that teams with different types of time perspective configurations will experience different knowledge creation outcomes, moving beyond monolithic “homogeneous” versus “heterogeneous” classifications.

Specifically, we argue that configurations or combinations of time perspectives among team members may range from *balanced* (i.e., an equal number of members who hold past, present, or future time perspectives) to *imbalanced* (skewed toward either past, present, or future time perspectives). These configuration possibilities are depicted in Figure 1.

[Insert Figure 1 about here]

We further suggest below that such configurations activate time perspective-based biases among team members which, in turn, impact the micro-processes underlying knowledge creation.

Knowledge Creation Processes

Following Nonaka (1994) and Argote (1999), we characterize knowledge creation as a predominantly collaborative, team-level phenomenon that uses individuals' inputs of tacit and explicit knowledge to build new knowledge. Previous literature suggests a wide array of processes that impact knowledge creation in general (cf. Amabile, 1996; Dougherty, 1992a, 1992b; Ford, 1996; Kessler & Chakrabarti, 1996; Sheremata, 2000; Woodman, Sawyer, & Griffin, 1993), and more specifically, the exchange of information in teams (Gibson, in press). While a complete review of these processes is beyond the scope of this paper, we suggest that at least three of these processes -- information search, alternative generation, and knowledge integration -- are highly likely to be affected by the time perspective biases of team members, and thus serve as mechanisms by which time perspective may influence knowledge creation.

As previously discussed, time perspectives can be thought of as a form of habitual cognitive bias, narrowing the range of behaviors involved in knowledge creation activities (Zimbardo & Boyd, 1999). Individuals will often prefer to engage in such habitual behaviors regardless of the motivations presented to produce creative solutions (Ford, 1996). As a result, time perspective biases may effectively filter out some past experiences and make others more

salient, depending on one's time perspective orientation. For example, a past time perspective bias may make only positive past experiences particularly salient, while a future time perspective bias may increase the salience of those past experiences which led to the attainment of goals. Because accumulated experiences lead individuals to develop interpretive schema, preferences, and expectations (Ford, 1996), if the accumulated experiences one draws from are biased by time perspective, the resulting schema or preferences are also likely to be biased. Further, if experiences are the building blocks for interpretive schema and preferences, particularly during sensemaking processes (Ford, 1996), the same biases may be operative when individuals ascribe meaning to new information or knowledge, interpret the worth of new ideas generated, or attempt to integrate or "cluster" new knowledge. General models of group development typically begin with some variety of information gathering activity (Waller, 1999), and it is likely that KWTs also begin the process of knowledge creation by examining and evaluating current information available for use (e.g. Choo, 1998: 29). Idea generation is also considered a key activity in the knowledge creation process (Paulus & Yang, 2000), while the integration of information by clustering and re-clustering of ideas and knowledge is a key knowledge creation process that helps individuals to re-conceive the meanings of old, new, and new combinations of knowledge Nonaka (1994). However, well-organized schemas, such as those based on strong time perspective biases, facilitate the imposition of habitual interpretations and actions on familiar circumstances, even in the face of considerable ambiguity (Ford, 1996).

Knowledge creation involves an intense search for information, generation of ideas, and integration of knowledge from different systems of meaning and different "thought worlds" (Dougherty, 1992a; Fleck, 1979; Mohrman, Gibson, & Mohrman, in press). As a consequence of its impact on those processes, we argue that time perspective differences among members in

newly formed KWTs differentially affect the speed of knowledge creation, and novelty of the knowledge created. Below, we provide examples of this logic based on various configurations of time perspective biases in knowledge work teams.

Balanced Teams

Teams with more balanced time perspective biases will be composed of near-equal or equal numbers of team members holding one of the three time perspectives. Specifically, although such differences generally provide breadth to information search activities, they also saddle teams with the task of managing the resulting interpersonal and communication conflicts (Williams & O'Reilly, 1998). The combination of (1) cautious, risk-averse past perspective members, with (2) impulsive, risk-embracing present perspective members, and (3) achievement- and goal-focused future perspective members is likely to create disagreements, misunderstandings, and conflict, particularly during interaction-intense idea generation and knowledge integration activities. Although time perspective balance may provide a basis for increased creativity through wider information search and an equal representation of time perspective biases, the overall mismatch of time perspectives within newly formed KWTs may result in inefficient, conflicted, laborious interactions during knowledge creation activities, and ultimately slow efforts to collaboratively create knowledge. The effect of these differences are similar to Steiner's (1972) conceptualization of process losses within groups, in that the speed of collaborative knowledge creation is closely linked to the coordination of group members' efforts. Thus, we propose:

P1: The more balanced the KWT time perspective configuration, the more slowly the team will create knowledge.

As stated earlier, both West and Meyer (1998) and Zimbardo and Boyd (1999) suggest that maintaining a balance or healthy tension among time perspectives may lead to higher levels of adaptability. Time perspective-balanced teams will have the opportunity to draw from information filtered by each of the three time perspective biases, and thus will be more likely to consider the factors in past successes, be pushed to embrace some risk, and be kept to some semblance of a plan or organization while maintaining a focus on the overall team goal. Likewise, assuming that most team members have equal voice, we suggest that combining elements of all three time perspective biases in a team will increase the likelihood that no one bias type will dominate idea generation or knowledge integration. In other words, since balanced KWTs represent equal amounts of the three time perspectives, time perspective-biased subgroups are less likely to form and sway team opinions based on specific time perspectives. In terms of information search, some past time perspective team members may be exploiting past actions while other more present time perspective members are exploring new information. Similarly, the present time perspective portion of the team will be engaged in divergent thinking while an equal future time perspective portion will be pushing for convergence, perhaps prematurely, by setting and enforcing deadlines. As a result, there will be balance and variation in information search, idea generation, and knowledge integration routines among members. Based on this functional multiple emphasis, we propose:

P2: The more balanced the KWT time perspective configuration, the more novel the knowledge created by the team.

Imbalanced Teams: Past, Present, and Future

In contrast, when there is an imbalance of past, present or future perspectives represented in a knowledge work team, the team is characterized by moderate time perspective differences,

and a dominant (but likely unnoticed) subgroup may form consisting of the members with the over-represented perspective. This subgroup may result in a time perspective bias for the team, which serves to focus, narrow, and constrain the construction and organization of experience at the individual level, and thus bias information search, interpretation, evaluation, and organization processes during knowledge creation activities at the team level.

Such a shared focus may also attribute to a mutually-reinforcing cycle of thinking in teams, such as the “groupthink” phenomenon (Janis, 1982) or inflated levels of group efficacy (Gibson, 1999; Whyte, 1998), and decrease the probability of teams disengaging themselves from a shared time perspective bias. Thus, when an imbalance in time perspectives occurs in KWTs, we suggest that a cognitive and behavioral narrowing across individual team members sharing the same time perspective biases will occur, resulting in a cumulative effect on the team’s efforts to quickly create novel knowledge. As explained below, we suggest that these time perspective biases have a net effect on both the novelty and speed of knowledge creation in teams.

Past Imbalance. When the overall time perspective configuration in newly formed KWTs is skewed toward a focus on the past, team members will generally (1) hold positive feelings about their past efforts and performance, and (2) avoid taking risks (Zimbardo & Boyd, 1999). Due to the attractiveness and low perceived risk of past successes, these team members are likely to habitually remember and use experiences and information about such efforts at knowledge creation in order to build metaphors and cluster knowledge (Ford, 1996). However, since the team members hold different positive past experiences, to gain a common understanding for collaboration, much time will be spent in their interactions recounting and explaining past experiences to each other, leading to a slow, cautious, step-by-step, laborious process of idea

generation and knowledge integration in the new KWT. The overall risk-averse attitude in the team will also lead to more testing or second-guessing of newly-integrated knowledge, further contributing to a slowing of knowledge creation efforts (Kessler & Chakrabarti, 1999). This process, combined with the possible absence of future-oriented planning skills such as milestone setting that make clear time-based objectives and tend to speed innovation (Kessler & Chakrabarti, 1999), leads us to posit:

P3: The more imbalanced the KWT time perspective configuration toward a past perspective, the more slowly the team will create knowledge.

Beyond the slowed pace of knowledge creation, the interpretive schemas and sensemaking processes used by team members with a past time perspective are likely to encourage them to habitually evaluate new ideas and new combinations of knowledge in terms of positive past experiences. This anchoring to past experiences is likely to result in an exploitation of past knowledge. Their general avoidance of risk-taking behavior – behavior that is considered to be a general requirement for innovative, creative work (O'Reilly & Tushman, 1997: 203) – is also likely to result in more incremental knowledge creation in these teams. Finally, these teams are less likely to engage in visceralization -- the process of imagining new knowledge, such as a new product idea, being used in the future by customers or end-users (Dougherty, 1992a). This latter process encourages team members to create vivid images of knowledge in use, and thus may enhance the development of more tacit concepts or metaphors useful in knowledge integration activities (Nonaka, 1994; Weick, 1979). Subsequently, most new knowledge created in these past-imbalanced teams is likely to represent incremental advances of what is already known (March, 1991), as opposed to break-through knowledge that is highly innovative.

P4: The more imbalanced the KWT time perspective configuration toward a past perspective, the less novel the knowledge created by the team.

Present Imbalance. In contrast to teams with more members holding past time perspectives, the micro underpinnings of knowledge creation in young KWTs with a present time perspective imbalance are likely to unfold in the context of high-energy, chaotic processes. These newly formed teams will be comprised of members who typically “live for the moment” and are generally unaware of time, but who at the same time are energetic, embrace risk-taking behavior, and actively seek novelty and excitement (Zimbardo & Boyd, 1999). In knowledge creation activities, such KWTs are likely to stop and start efforts at idea generation and knowledge integration many times due to members’ lack of patience for methodically building upon the ideas of others, thus slowing the overall speed of knowledge creation. Additionally, these team members’ need for excitement and generally impulsive behavior is likely to lead present-oriented teams to eschew future-oriented planning, milestones, or deadlines, and be generally unaware of the passage of time (Zimbardo & Boyd, 1999: 1275). Thus we suggest:

P5: The more imbalanced the KWT time perspective configuration toward a present perspective, the more slowly the team will create knowledge.

As suggested above, past- and present-perspective biased KWTs will both likely be relatively slow at creating new knowledge, *albeit for different reasons*. With regard to the novelty of new knowledge, however, present-skewed teams are unlikely to rely heavily on information gathered from past experiences as a basis for building metaphors or for clustering new ideas. The categorization of ideas and the integration of individuals’ ideas into new knowledge in such teams is likely to be a spontaneous, risk-taking event. And while these teams

may be the slowest at knowledge creation, the high variance of their risk-based actions may lead to the greatest returns in terms of knowledge novelty. Indeed, we expect such teams to best fit March's (1991) characterization of "knowledge explorers." Specifically, as the behavior experiences used by these team members are likely to focus on pleasure, excitement, and novelty (as opposed to past success and predictability), the information processing and interpretations dominant in teams comprised mostly of members with present time perspectives will likely facilitate the development of new, novel knowledge. Thus, we predict:

P6: The more imbalanced the KWT time perspective configuration toward a present perspective, the more novel the knowledge created by the team.

Future Imbalance. Finally, KWTs with a future time perspective imbalance will be composed mostly of team members who are (1) focused on planning for and achieving future goals, (2) seeking consistency, and (3) *not* seeking novelty (Zimbardo & Boyd, 1999). The behavioral experiences used by these team members are likely to have direct connections to either past goal attainment or attainment of future goals. As in past time perspective KWTs, individuals in future time perspective teams will need time to explain to each other their different past experiences that led to goal attainment. Unlike past time perspective teams, however, future time perspective team members will be highly aware of time, milestones, and deadlines, and will most likely exhibit characteristics of time urgent behavior. Researchers have identified time urgency, or a frequent concern with the passage of time, as a stable individual difference variable (Conte, Landy, & Mathieu, 1995; Conte, Mathieu, & Landy, 1998). Strikingly similar to descriptions of future time perspective individuals, individuals with high levels of time urgency typically engage in time-related behaviors including time awareness, scheduling, task prioritization (or list making), and deadline control. Individuals who are time urgent tend to

constantly check the passage of time and make schedules, lists, and deadlines for themselves (Conte, Mathieu, & Landy, 1998), and are likely to become agitated if previously planned timelines and milestones are not followed. Thus, we propose that:

P7: The more imbalanced the KWT time perspective configuration toward a future perspective, the faster the team will create knowledge.

Furthermore, although future-imbalanced KWTs are likely to meet knowledge creation deadlines, the novelty of the knowledge they create may tend toward the incremental. Most of the information search activities in these teams will be limited to only that information that immediately and clearly relates to goal attainment. However, the creation of novel or breakthrough knowledge is a sporadic process that rarely fits a well-planned timeline (Mascitelli, 2000), and given the choice, future-imbalanced KWTs are likely to opt for adhering to previously-set milestones and plans rather than deviate from plans to spend more time on idea generation or information search. Ironically, individuals with future-oriented time perspective biases may be more likely than individuals with other biases to engage in visceralization and imagine future uses of new knowledge when evaluating or generating ideas. However, unless visceralization activities fit into the timeline and plans developed by future time perspective KWTs, visceralization too is likely to be abandoned in favor of developing a more incremental idea rather than risk missing planned milestones or deadlines for knowledge creation. In addition, attention to deadlines may result in premature efforts at integrating knowledge, forcing convergence before optimally appropriate, in turn reducing the novelty of knowledge created. We thus propose the following:

P8: The more imbalanced the KWT time perspective configuration toward a future perspective, the less novel the knowledge created by the team.

In summary, we have developed a framework showing how different configurations of time perspectives among individuals in teams may influence the speed and novelty of knowledge creation. Specifically, we proposed that different configurations of time perspective biases in teams affect processes key in knowledge creation efforts, and ultimately produce different effects on the speed and novelty of the knowledge created. The implications of our framework for theory and practice are discussed below.

DISCUSSION

It has been suggested that successful organizations in the 21st century will consist of networks of highly adaptable, flexible temporary teams (Nadler & Tushman, 1999). Such organizations will become more like living, breathing, adaptable entities which constantly shift people, attention, and resources to match the dynamism of their competitive environments. In many instances, new knowledge will be created and will appear on customers' computers (or telephones or other digital devices) the same hour or day that it is created. Only the rapid creation of novel knowledge by flexible, ever-shifting teams will give organizations the opportunity to flourish in such environments. Here we suggest that regardless of whether or not knowledge work teams meet face-to-face or as virtual teams, their time perspective configurations will likely have a significant impact on knowledge creation activities, and will ultimately influence the organization's ability to keep in step with a 21st century environment.

Our framework suggest that, *ceteris paribus*, the configuration of time perspectives among team members will lead to different knowledge creation outcomes in KWTs. We suggest that any imbalance in this configuration will lead to systematically biased information search, idea generation, and knowledge integration activities that affect both the speed of

knowledge creation and the novelty of the knowledge created. Given the centrality of KWTs in overall organization innovation efforts, developing an understanding of any factor that biases the deeply embedded knowledge creation processes within these teams would seem a worthwhile endeavor. Indeed, such factors as the increasingly multicultural complexion of these teams as firms reach across national boundaries for knowledge workers and the strong correlations between national cultures and dominant time perspectives (Hall, 1983; Kluckhohn & Strodtbeck, 1961; Levine, 1997) suggest that the effects of time perspective balance and imbalance in KWTs may prove to be a particularly useful explanatory factor of multicultural KWT knowledge creation performance.

Our theory concerning time perspective effects on team knowledge creation augments theory and research in at least three domains. First, the framework presented here contributes to the literature on groups and teams. Only recently has this literature begun to recognize the importance of time and timing in team functioning (Gersick, 1988, 1989; Perlow, 1999; Waller, 2000). The work presented here identifies a specific time-based characteristic and explicates how time perspective imbalances across team members might influence team knowledge creation processes. Further, we specify how time perspective, as a particularly important characteristic of team composition, functions to impact processes in teams, distinguishing these effects from other types of team heterogeneity. While our work focused on the speed and novelty of knowledge creation, time perspective configurations may similarly affect other team outcomes. For example, the various forms of conflict in groups identified in previous studies (e.g. Jehn, Northcraft, & Neele, 1999) may have developed, at least in part, from time perceptions differences that led some group members to value past- or future-oriented ideas and others to devalue them. Similarly, even groups that employ highly-structured templates such as

nominal group technique (e.g. Hegedus & Rasmussen, 1986) may not be immune to the group-level biases of certain time perspective configurations in their idea evaluation efforts.

Second, our framework contributes to the literature on knowledge management. That growing body of literature is in the nascent stages of development and has yet to fully address the complexities of knowledge creation in team settings. This paper helps identify specific characteristics of the knowledge creation process that are likely to be affected by time perspectives. It similarly provides a starting point in forging a linkage between knowledge management work and research concerning the influences of time. Such an integration of theoretical perspectives is critical given the realities of knowledge creation within fast-paced environments. While our theory focuses on the effect of time perspective configurations on the expedience and novel outcomes of relevant knowledge creation activities, our work suggests the criticality of investigating the impact of this and other configurations on additional measures of the content, quality, and output of knowledge creation efforts. Overall, testing the propositions presented here will help inform theories developed to predict knowledge creation outcomes in time-pressured business environments.

Third, our work suggests a boundary condition to research concerning group and team dynamics under deadline conditions. Overall, previous studies in this area have not investigated the effect of time perspective configurations on team outcomes (cf. Lim & Murnighan, 1994; Gersick, 1989; Waller, Giambatista & Zellmer-Bruhn, 1999). While most of these studies randomly assigned subjects to groups and thus controlled for time perspective differences among group members, it is possible that the findings of these studies may not be generalizable to groups with members who hold very similar time perspectives. For example, Gersick (1989) found that groups working under deadline conditions tended to exhibit a time-catalyzed

“midpoint transition” after half of their allotted time had expired. However, this finding may not apply to groups with members holding only present time perspectives because the deadline may not motivate similar time-related behaviors for these individuals. Similarly, the deadline conditions simulated in other studies may be perceived quite differently by groups comprised of individuals with only present, past, or future time perspectives, respectively.

Future Research

We focused here on the effects of KWT time perspective configurations on the speed and novelty outcomes of knowledge creation efforts. We believe that future research testing the propositions presented here will add important insights to both knowledge management and group dynamics literatures. One area particularly relevant for future research concerns field studies on new product development teams. Preliminary evidence indicates that such teams struggle with differences in time perspectives, and that the development of enabling conditions that mitigate differences is an important mechanism for increasing the effectiveness of the teams and the long term viability of teams as a driver of performance in multinational organizations (Cohen & Gibson, 2000). Other research efforts may be directed toward behavioral laboratory experiments that (1) identify individuals' time perspectives using the Zimbardo Time Perspective Inventory (Zimbardo & Boyd, 1999), (2) arrange subjects in teams representing the time perspective configurations we have suggested here, and (3) assign tasks to teams that require creative or innovative solutions, and (4) evaluate team outcomes on the basis of creativity and speed.

Future research testing the propositions presented here will add insights to both knowledge management and group dynamics literatures, but our arguments can also be extended in several additional directions. Such research should investigate the effects of time perspective

configuration on additional content outcomes of knowledge management activities, like adherence to stated goals or organizational strategies. Similarly, the speed and novelty of knowledge creation within teams may not be the only process outcomes affected by time perspective configurations. As mentioned previously, knowledge transfer among teams is considered to be a key component in knowledge management activities. The differences among teams in their overall time perspective configurations may help or hinder the ability of teams to share new knowledge with each other. Finally, the overall distribution of “present”, “past”, “future, and “balanced” teams throughout an organization may affect the degree to which firms are able to learn by *exploitation* -- leveraging "old" knowledge embedded in a team or in other parts of the organization -- or *exploration* -- learning through experimentation and discovery (Earley & Gibson, in press; March, 1991).

While we suggested several effects of time perspective configuration on knowledge creation in KWTs, the boundary conditions of our framework provide additional opportunities for future research. First, we have assumed no effect for team members’ prior experience in imbalanced time perspective teams. It is possible that team member with high levels of experience in creating knowledge under imbalanced time perspective conditions develop and import coping mechanisms that alleviate some of the effects we detailed here. Consequently, studying both novice and expert team members could help identify these latent differences, inform group dynamics theories, and suggest future training interventions. Second, we have assumed that knowledge work teams have very short life-spans and do not enjoy longevity sufficient to develop the norms and routines necessary to cope with some of the biases introduced by imbalanced time perspectives. Future work should investigate the possible development and usefulness of these norms and routines by teams that work together for longer

periods of time without membership changes, particularly given the influence of team longevity in some circumstances (Watson, Kumar, & Michaelsen, 1993).

A third boundary condition of our theory pertains to the antecedents of time perspective orientations and biases. Our theory concentrates on examining the effects of time perspective biases in KWTs after such biases have been ingrained in individuals as stable individual differences. However, previous work has suggested that the forces leading individuals to form past, present, or future perspectives of time may include mostly cultural (Kluckhohn & Strodtbeck, 1961; Jones, 1988; Levine, 1997) factors, or may also include educational, religious, organizational, social class, and family factors (Zimbardo & Boyd, 1999). The differential effects these various antecedents could have on the development and resulting biasing forces of time perspective orientations is beyond the scope of our theory. Future longitudinal research could add much to our understanding of how time perspectives are developed over time, how they may change as individuals are exposed to different organizations, functional areas, cultures, and lifestyles, and what impacts these changes have in teams and organizations striving to develop new knowledge consistently and quickly.

Practical Implications

In addition to theoretical contributions, the time perspective framework developed in this paper contributes to organizational practice in several ways. For instance, our framework is relevant to work in organizational design, particularly in cases where costly design efforts are intended to facilitate learning by speeding the flow of information throughout the organization (Nadler & Tushman, 1997). In particular, the many vertical and horizontal cross-border structural linkages make organizational design in multicultural firms especially complex. However, unless time perspective configuration is accounted for and managed, even the "best"

organizational design may be unable to overcome some of the problems associated with the configurations described here, and thereby frustrate the "capability of a company as a whole to create new knowledge, disseminate it throughout the organization, and embody it in products, services, and systems" (Nonaka & Takeuchi, 1995: vii).

The framework similarly contributes to the literature on person-organization fit, in that we have delineated specific contingencies that should be taken into consideration when designing teams around tasks. Team composition and task structure are critical design features in organizations, and we suggest that the time perspective configuration is a key composition issue. Other researchers have similarly found the fit between individual time-based orientations and overall work group orientation to be a significant influence on performance factors (Slocombe & Bluedorn, 1999). We suggest that the time perspective configuration impacts characteristics of the knowledge created. Testing the propositions presented here may be particularly helpful in informing theory regarding team-based organizational designs. In that view, teams can be formed around tasks with certain knowledge creation requirements, and knowledge creation tasks can be structured around teams with certain time perspective configurations.

Empirical investigation of the propositions will reveal practical information helpful in the structuring of processes, formation of teams, and the design of goal and reward systems. Managers may find it useful to match time-perspective differences with structure and reward systems. For example, if time perspective differences are severe within a team, managers may find that by providing greater slack (if possible) regarding time limits or helping the team to design a knowledge creation process that assigns members to specific roles based on their time perspective biases could improve performance. Managers may also employ technological

templates or schematics helpful in encouraging and reminding individual team members to draw on experiences from all time perspectives -- past, present, and future -- when gathering information or evaluating new ideas. Similarly, helping teams cooperatively set shared knowledge creation expectations or midrange goals may help avoid some of the process conflict that slows knowledge creation in balanced time perspective teams.

In conclusion, organizations are increasingly coping with more global, turbulent, and information-rich environments by relying on teams to rapidly create innovative knowledge. The relationships we proposed above are intended to bring this aspect of time-based competition to the attention of organizational researchers by demonstrating the importance of time perspective for theory building, and by further alerting theorists and practitioners alike to possible boundary conditions for assumptions about time.

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FIGURE 1
Proposed Relationships Between KWT Time Perspective Configuration and
Speed and Novelty of Knowledge Creation



