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WHEN IS AN HOUR NOT 60 MINUTES? DEADLINES, TEMPORAL SCHEMATA, AND INDIVIDUAL AND TASK GROUP PERFORMANCE

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We investigated variation in how deadlines are experienced based on whether they match culturally entrained milestones. Consequences for task performance were also examined. We manipulated starting times on two experimental tasks as prototypical (e.g., 4:00 p.m.) or atypical (e.g., 4:07 p.m). In one experiment, each of 20 task groups was to create a television commercial in one hour. Groups' time pacing and performance varied significantly, and groups with prototypical starting times performed better. In a second experiment, 73 individuals were to divide time equally between two tasks. Individuals with atypical starting times performed more poorly on their second tasks.

Temporal issues such as scheduling, activity pacing, and conformity to organizational and societal rhythms are extremely important and permeate our lives (e.g., Kelly & Karau, 1993). For example, the one-hour shift associated with the transition to daylight savings time annually is significantly related to an 8 percent variation in the number of traffic accidents immediately following the transition (e.g., Grekin & Coren, 1996). In another example, scientists at the Jet Propulsion Lab working with Mars Rovers that are powered by solar radiation must work according to the temporal rhythms dictated by the Martian day (a "sol"), which is 37 minutes longer than an Earth day. This seemingly minor 37-minute difference in day length produces severe jet lag–like symptoms in JPL scientists within days of working on the Rover project, and it has necessitated a shift in the way that scientists' workweeks are scheduled (Daley, 2004). Because of the ubiquity of temporal issues, they tend to be low in salience and to fade into the background, which often blinds researchers to their importance. Recently, organizational researchers have begun a push to increase their understanding of the effects of time in organizational life (e.g., Albert, 1995; Barkema, Baum, & Mannix, 2002; Goodman, Lawrence, Ancona, & Tushman, 2001; Marks, Mathieu, & Zaccaro, 2001). In two studies, we further this understanding by taking a schema perspective on issues of deadline perceptions and their consequences for pacing and performance.

We examine how both individuals and groups pace their activity in "clock time." Clock time is the dominant way of describing time in Western society. Clock time depicts time as a linear continuum, infinitely divisible into objective, quantifiable units in such a way that the units are homogeneous, uniform, regular, precise, deterministic, and measurable (Ancona, Okhuysen, & Perlow, 2001; McGrath, 1988). Clock time is a socially constructed convention used to organize and segment time into intervals that are punctuated by salient temporal milestones, such as project deadlines (Albert, 1995; Lauer, 1982; Yakura, 2002). Our main contribution is to deepen understanding of the cognitive underpinnings of the way time and deadlines are perceived by individuals and groups as they attempt to schedule activities in clock time. We view deadlines as environmental stimuli that need to be perceived, interpreted, and remembered in order for people to pace their activities appropriately for the task at hand. As is the case with perceiving all stimuli, perceiving and interpreting

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time and deadlines are mentally organized via schemata—in this case, temporal schemata.

STUDY 1

Temporal Schemata

Schemata are generalized cognitive frameworks that give form and meaning to experience and contain general knowledge about a domain. They are collections of related ideas and specific examples about the domain, which in this case is clock time. One of the chief functions of schemata is to help a person identify and interpret incoming stimuli, including deadlines (Taylor & Crocker, 1981; see also Bartunek & Moch, 1987; Gioia & Poole, 1984; Markus & Zajonc, 1985; Schank & Abelson, 1977). Although schema theory was originally oriented toward the individual, more recently researchers have argued that schemata can also be shared among members of groups, organizations, and cultures through a process of social influence and negotiation (e.g., Bartunek, 1984; Lord & Foti, 1986; Poole, Gioia, & Gray, 1989; Labianca, Gray, & Brass, 2000).

When a team comes into existence, it establishes a temporal schema that differentiates its members' understanding and experience of time and deadlines from that of others (cf. Perlow, 1999; Zerubavel, 1979; see also Lawrence, 2001, on timing norms). Ancona and Chong (1996) argued that a team's external context (e.g., its broader organization, its industry, the general economy, and the broader culture) influences its temporal schema in such a way that the team becomes socially "entrained" to temporal patterns that emanate from the external context. Social entrainment is the "capturing and modification of human activity cycles by various customs, norms, and institutions" (McGrath & Rotchford, 1983: 78; see also Ancona & Chong, 1996; Kelly & McGrath, 1985). The fundamental idea behind entrainment in a team, which we adopt in this study, is that cycles outside the team's system, such as culturally prevalent clock time milestones, influence the team's endogenous cycles, including subdeadlines and work pace, which synchronize to the external cycles. We argue that, in the same way that Americans' sleep cycles become entrained to standard time, and then disrupted with the culture's shift to daylight savings time, team members will face disruptions when deadlines are imposed that are not synchronized with prototypical ways of viewing clock time in their culture. Entrainment's focus on the effects of external temporal rhythms on internal team processes stands in contrast to the more internally focused models of group development that preceded entrainment models (e.g., Tuckman, 1965; Tuckman & Jensen, 1977). The focus of the previous research was mainly on how groups proceed through various phases of their existence (such as "forming," "storming," "norming," "performing," and "adjourning") with little regard for their temporal environment (see Wheelan [1993] for an integration of group development research).

Research on Time in Teams and Organizations

Gersick (1988, 1989) focused, as we do initially, on task groups, which she defined as one-shot project teams typified by vaguely defined goals, a great deal of autonomy, an external clientele for the end product, and specific deadlines. Her major contribution was to focus attention on the effects of temporal inputs, such as externally driven deadlines, on a group's internal process, including its work pacing, and on its ultimate performance. Gersick found that externally driven deadlines sparked task-related transitions at the approximate midpoint of a group's temporal existence. Subsequent research inspired by Gersick's "punctuated equilibrium" model (e.g., Chang, Bordia & Duck, 2003; Lim & Murnighan, 1994; Okhuysen & Waller, 2002; Seers & Woodruff, 1997), has promoted a more contextualized view of group development.

Gersick's later work (1994) has more of an entrainment perspective in that it focuses on how external pacers, such as quarterly reports, monthly meetings, and annual planning episodes, influence activities within start-up companies. These external pacers increased time pressure at certain points during the calendar year and decreased time pressure at other points. Several studies support the importance of external pacers. For example, Humphrey, Moon, Conlon, and Hofmann (2004) found that both individuals and organizations tended to focus on productivity to the detriment of safety toward the midpoint of deadline-driven projects. Waller (1999) found that the timing of a group's responses to an externally induced nonroutine event affected team performance. Perlow's (1999) qualitative work on a software engineering team showed that the lack of a well-articulated and negotiated temporal schema for individual and interactive activities in a group could lead to excessive interruptions and poor subsequent team performance. Similarly, Montoya-Weiss, Massey, and Song (2001) found that temporal coordination in global virtual teams in an experimental setting reduced internal conflict and increased team performance.

Recent theorizing and organizational research on time are increasingly demonstrating a cognitive perspective in their focus on how individual team members perceive deadlines and their exploration of the implications of these deadline perceptions for teams' performance (Conte, Landy, & Mathieu, 1995; Waller, Conte, Gibson, & Carpenter, 2001; Waller, Zellmer-Bruhn, & Giambatista, 2002). Blount and Janicik (2001) argued that individuals organize their work activities around a prevailing temporal agenda, and that when there are necessary changes to deadlines, individuals evaluate those changes negatively to a greater or lesser extent on the basis of outcome, experiential, attributional, perceiver, and context effects.

Although we are also focusing on perceptions of deadlines, our work differs from these recent studies in a number of ways. We focus on a team as a whole to understand its temporal schema, rather than aggregating individuals' time perceptions or attempting to understand each individual's time orientation. We also take an explicitly schema-oriented perspective in explaining how groups perceive deadlines, rather than relying on concepts such as temporal agendas, temporal structures, or timing norms (e.g., Ancona, Goodman, Lawrence, & Tushman, 2001) that are not specifically cognition-based. This perspective allowed us to get a specific understanding of the structure of teams' temporal schemata (e.g., whether they are organized around prototypes). A number of the empirical studies cited above have shown that deadlines can influence a group or organization to alter its behaviors, yet they have not combined a schema perspective, which focuses on temporal perception, with an entrainment perspective, which focuses on the meshing of these deadlines with external cultural rhythms (Ancona et al., 2001), to get a better understanding of how a group internalizes these deadlines.

Temporal Milestones and Group Process

Our first study focuses on explaining how externally imposed group deadlines that deviate from dominant cultural rhythms for clock time cause difficulties with group members interpreting the deadlines and affect subsequent pacing and, ultimately, group output. We argue that when the members of a task group are provided a deadline for a project, the deadline is an environmental stimulus that must be perceived and interpreted through the group's temporal schema (cf. Michon, 1992; Roeckelein, 2000). But the degree to which the deadline is congruent with the dominant cultural view of clock time will ultimately determine the ease with which the deadline is accurately perceived, interpreted, stored, and later remembered.

The rationale behind this lies in the argument that schemata are often organized around specific examples and that those examples that are considered most *prototypical* are given the greatest weight or degree of importance (e.g., Hampton, 1979; Posner & Keele, 1968; Rosch, 1978). These prototypical examples are the easiest to learn and to recall and are more likely to serve as cognitive reference points than are atypical examples (e.g., Battig & Montague, 1969; Danks & Glucksberg, 1980; Mervis, Catlin, & Rosch, 1976; Rosch, 1973, 1975). The classic example of this phenomenon is to examine recall of a concept such as "bird." People are most likely to recall a sparrow or a robin, rather than a large, flightless bird such as an ostrich, because the former are more prototypical examples of birds than an ostrich.

Western clock time creates temporal schemata that are similarly organized around prototypical examples built around the concept of an hour, which is comprised of 60 equal minutes (McGrath & Rotchford, 1983). Even in an era of digital and atomic clocks that provide incredible precision, members of the Western culture share temporal schemata that are oriented around quarter-hour increments that hearken back to our culture's entrainment to mechanical analog clocks. Although each of the 60 minutes in an hour is objectively equal, some minutes are considered more prototypical (e.g., 4:00, 4:15, 4:30, 4:45), while others are considered less prototypical (e.g., 4:07, 4:22, 4:37, 4:52). As children in Western society are taught to "tell time," they are taught to learn the top of the hour, the bottom of the hour, and the quarter hours. Eventually, they learn the rest of the 60 minutes, and a temporal schema is formed where some minutes are more prototypical than others. These special minutes serve as cognitive reference points.

People bring these temporal schemata with them to the workplace, and the schemata affect how they interpret deadlines. When the starting times and deadlines for a group's project are prototypical (e.g., 4:00 p.m. and 4:15 p.m.), mental processing of these deadlines will be very easy. Compared to atypical deadlines, the deadlines will be perceived and interpreted more accurately, stored in memory more accurately, and thus will be easier to recall. It will also be easier for group members to calculate how much time remains in the group's project life span because this will be a fairly prototypical calculation, and so it will be easier for the members to pace and schedule their activities appropriately throughout the project. As an example, if you know the deadline is 4:00 p.m., and it is now 3:23 p.m., it is easy to calculate the time remaining (37 minutes) because it is a prototypical calculation in Western clock time. However, if the deadline is 3:52 p.m., the time-remaining calculation at 3:23 p.m. (29 minutes) involves greater cognitive difficulty because it is atypical from a Western clock-time perspective. Although there is little difference objectively in the calculations, the one involving prototypical times will be easier and less distracting (Battig & Montague, 1969; Mervis et al., 1976), and should result in fewer errors. In summary, we argue that the deadline is more likely to be misheard in atypical deadline groups, more likely to be stored in memory incorrectly, more likely to be retrieved from memory incorrectly, and more likely to create cognitive difficulties in pacing for the group, which will manifest visibly in greater errors in calculating the time remaining until the deadline.

Hypothesis 1. Task groups with atypical deadline times make more errors in calculating the time remaining until the deadline than task groups with prototypical starting times.

The greater cognitive difficulty and distraction involved in atypical deadline calculation should also lead to more time consciousness in task groups with atypical deadlines than in task groups with prototypical deadlines. *Time consciousness,* or the extent to which task group members pay attention to an externally imposed deadline, is based on Schriber and Gutek's (1987) notion of time awareness. Because atypical deadlines are harder to store in memory accurately and more difficult to recall, we expect that there will be more confusion surrounding deadlines, which will necessitate greater attention to clock time in these groups.

Hypothesis 2. Task groups with atypical deadline times are more time conscious than task groups with prototypical starting times.

We expect that the greater cognitive difficulty associated with perceiving and remembering atypical deadlines, making atypical deadline calculations, and the attendant increased time consciousness owing to atypical deadlines, will distract from the main task and will harm the scheduling and pacing activities within a task group. Task groups generally need to move through two main phases in order to accomplish their tasks: a planning phase and an action phase (see Marks et al. [2001] for an extended discussion of these phases and for a taxonomy of team processes). The planning phase of a team's life involves interpreting and evaluating the team's task, identifying and prioritizing goals and subgoals for task accomplishment, and developing a strategy for task accomplishment. The action phase focuses on processes more oriented to imminent task accomplishment, such as monitoring progress toward goals, internal and external systems monitoring, team monitoring, and coordination of interdependent actions (Marks et al., 2001). Task groups must make the transition between these two phases in a timely fashion in order to complete their task successfully (cf. Perlow, 1997; Waller, 1999), although we acknowledge that phases are not necessarily lockstep, one-time occurrences in real-world task groups. Thus, it is critical that group members schedule and pace their activities well, monitor their temporal progress throughout a group's life, and yet remain focused on task accomplishment throughout the group's life.

We argue that when groups schedule and pace their activities, including the transition from the planning to the action phase of the group's life, they are orienting their group activities around culturally entrained temporal milestones. Essentially, they are being given a defined period of time to accomplish a task, and they are setting a mental stopwatch as a reminder that they can spend a certain amount of time in planning, but that eventually they need to move to the action phase. We term the point of the shift from the planning phase to the action phase the "staging point." For example, in Gersick's (1989) laboratory research, all the teams assembled at prototypical times (on the hour) and some respondents noted that they were ready to transition earlier than the midpoint, but that they did not suggest transitioning until the halfway point (which would have been half-past the hour in clock time—another prototypical time). The dilemma arises in groups with atypical times. If the members of such a group begin an hour-long project at 4:07 p.m. and decide that they want to transition at the exact midpoint of the group's existence, they have to select an atypical minute on which to set their mental stopwatches (4:37 p.m.). Since this setting contradicts their culturally ingrained clock-time temporal schema, it necessitates cognitive effort and distraction from their main task, so they are much more likely to set their mental stopwatches on a temporally close, schema-consistent milestone (e.g., 4:45 p.m.). They theoretically have the option of setting their mental stopwatches on an earlier milestone as well (e.g., 4:30 p.m.), but in practice, they become engrossed in the first phase of group activity, lose track of time, and end up setting their mental stopwatches for the later temporal milestone.

Hypothesis 3. Task groups with atypical starting times transition from the planning phase to *the action phase later in the group life than groups with prototypical starting times.*

If a task group does not spend enough time in the action phase, its output can suffer (Marks et al., 2001). Simply put, if a group transitions from planning to action too late, its members spend a disproportionate amount of time discussing what they are *going to do,* but they don't spend enough time putting together and rehearsing what they will *actually do*. The expectation that a task group with an atypical deadline will shift from planning to action later than a group with a prototypical deadline further implies that the atypical-deadline group perceives increased time pressure as the deadline approaches. Previous research has shown that increasing time pressure generally leads to faster performance, but lower performance quality (cf. Beersma, Hollenbeck, Humphrey, Moon, Conlon, & Ilgen, 2003; Karau & Kelly, 1992; Isenberg, 1981; Pepinsky, Pepinsky, & Pavlik, 1960). By transitioning late, a group can end up with both too little time and high perceived time pressure, both of which can lead to worse performance independently or multiplicatively.

Hypothesis 4. Task groups with atypical starting times perform more poorly than groups with prototypical starting times.

Methods

It would likely be impossible to study our research question in a field setting because of the lack of control over the great many variables that could affect group processes and outcomes outside of the prototypicality of the deadlines. Our laboratory experimental design allowed us to maintain tight control over such variables as the amount of time allotted for task completion, the beginning and ending times, and the standardized task, while minimizing potential confounds, such as team composition effects.

Volunteer participants were recruited from introductory undergraduate management courses taken during their junior year at a private U.S. university. The use of students from the same course and university allowed us to minimize heterogeneity in age, knowledge, skills, and abilities. The students were assigned to groups using a quota sampling technique (Miller, 1991) in order to assure that each group was heterogeneous with respect to gender (that is, each group had at least one member of each gender) to minimize possible group composition effects. The number of students in each group was allowed to fluctuate from three to six.

We employed an experimental laboratory design where 10 of the 20 groups were begun at atypical times (hereafter, we refer to these as the "atypical groups") and the remaining 10 were begun at prototypical times (the "prototypical groups"). The groups were randomly assigned to different experimental conditions as to deadline prior to scheduling the participants. Thus, 5 of the 10 atypical groups were begun at 52 minutes past the hour, while the other 5 were begun at 7 minutes past the hour. Five of the prototypical groups were begun at 45 minutes past the hour, and the remaining 5 of the prototypical groups were begun on the hour. We had no group wait less than 15 minutes or more than 22 minutes to begin the experiment, in order to minimize the possibility that waiting time could contaminate the results.

We provided participants with a task similar to Gersick's (1989) task. The groups were to assume the role of professional advertising writers, and they were charged with creating and then taping a 60-second commercial for a Web site that sold student textbooks. The groups had exactly one hour to create and rehearse the commercials, and then 60 seconds to act out the commercials. To encourage participants to take their task seriously, they were informed that actual advertising executives would evaluate their commercials and that the members of the group creating the best commercial would be awarded extra class credit.

The groups met in a video studio in the university's business school building. A table with chairs and a computer running the textbook Web site for which they were creating the commercial sat in the center of the room. To minimize potential distraction and remove temporal cues (e.g., the setting sun), we had all walls and windows covered by heavy floor-to-ceiling drapes. Subjects were provided a box full of props to use for the commercial. The only other item in the room was an analog wall clock attached to the back wall drape, which was used as the "official" clock for the experiment. Because of the seating arrangement, students had to turn around to see the clock. Two video cameras and one audio microphone captured a group's interactions throughout the hour.

A research assistant briefed participants on their task and then told them, "According to this clock (pointing to a clock placed on the wall behind the participants), it is now [3:45; 3:52; 4:00; 4:07]. I'll be back in an hour. So at [4:45; 4:52; 5:00; 5:07], I'll walk back into the room, head over to this camera, and I'll say action and you'll have exactly 60 seconds to tape your commercial." The researchers (one or both authors and a research assistant) monitored the proceedings from an audio-video booth next to the studio.

Measures

Time measures. Two new research assistants who had no knowledge of the study's hypotheses or of the manipulation analyzed the videotaped conversations independently, then met to achieve consensus on the group process variables mentioned below. Group process was analyzed minute-by-minute (cf. Chang et al., 2001; Gersick, 1989).

The *time consciousness* variable tracked the number of times group members either performed a time check (e.g., looked at the clock provided in the room, or looked at their wristwatches) or made a time statement (e.g., "We have 20 minutes left" or "We've got plenty of time"). This variable represented the extent to which they were paying attention to the externally imposed deadline.

The *staging* variable tracked the amount of time that a group spent acting and rehearsing the commercial. Each work group followed the same developmental process: in the initial planning phase, group members met and introduced themselves and then acquainted themselves with the Web site for which they were to create the commercial. After exploring the Web site, they would begin to introduce ideas for commercials and debate possible content. After making a preliminary decision on the commercial's content, the group would move into the action phase, in which members would begin to stand up and decide how act out their commercial. This is the point that we called the staging point. Groups reaching the staging point (which came at times varying from only 22 minutes to over 55 minutes into the task) earlier tended to have more rehearsals prior to filming the final version of their commercials ($r = .53$, $p < .05$). Together, the time consciousness and staging variables provide an overall assessment of the groups' temporal pacing.

To capture errors in the groups' time-remaining calculations, the coders tracked statements that group members made announcing or inquiring about the time remaining (e.g.,"How much time do we have left?" and "We have 20 minutes"). The number of times such statements occurred was entered as a group's *time calculations*. The coders then determined the actual time remaining at the point of any announcement of time remaining to determine if the group members had over- or underestimated, and by how much. For example, if a group member said that the deadline was in 20 minutes, when it was, in fact, 22 minutes away, he or she had underestimated by 2 minutes. These over- and underestimations were considered the group's *temporal imprecision*. The absolute value of these errors was used to determine how "lost in time" the groups were. We used a "$\log_{10}$" transformation to correct this variable's skew. Finally, because the error of overestimating time remaining was especially detrimental to performance (because participants could run out of time to rehearse), we calculated the number of times groups made those overestimation errors *(number of overestimation errors).*

Group performance measure. Each group had one chance to tape its commercial. The researcher would walk into the video studio after exactly 60 minutes had elapsed, walk over to the camera, and say "Ready" and then "Action." The group members had exactly 60 seconds in which to tape the commercial. Groups that went beyond the allotted 60 seconds ($n = 4$) were cut off, and their commercials ended abruptly.

The 20 commercials were placed in random order on a single videotape and sent to two judges who ranked them on overall quality (a commercial's suitability to run in a national primetime slot, and its ability to get the viewer to use the textbook-purchasing Web site). The judges were advertising executives with MindShare, Inc., a New York–based advertising firm, whom the first author had recruited. The judges (one male, one female), who have a combined 21 years of advertising experience and have worked closely together on television advertising, were blind to the hypotheses and the manipulation. Each independently ranked the commercials (Kendall's tau $b = .74$), and they then came to a consensus on the rankings. Consensus-ranking decision making using the criteria identified above is the normal procedure that these executives use when deciding on which advertising ideas to present to their clients.

Results

Table 1 gives group means, overall means, standard deviations, and correlations. Table 2 gives the results of a multiple analysis of variance (MANOVA) with one-tailed significance tests, conducted as our hypotheses were directional. Figures 1a–1d depict various results pertaining to differences between the atypical and prototypical groups.

Hypotheses 1 and 2 state that task groups with atypical deadlines make more errors in time calculations and are more time conscious than groups with prototypical deadlines. Results indicate that the groups with atypical deadlines were more temporally imprecise: they miscalculated the time remaining to complete the task (both overestimating and underestimating) more than the prototypical groups did ($t_{1,\ 18} = 2.14$, $p < .05$). The number of times that atypical groups overestimated the

TABLE 1
Bivariate Correlations, Means, and Standard Deviations for Study 1[a]

Variable	Mean	s.d.	1	2	3	4	5	6	7
1. Starting time	0.50	0.50							
2. Group size	4.00	0.80	.26						
3. Time consciousness	24.70	8.28	.24	.02					
4. Staging	18.45	10.06	.46*	.25	.08				
5. Time calculations	3.85	1.84	−.42†	−.04	.36	−.17			
6. Temporal imprecision	0.81	0.38	−.45*	.29	.29	−.21	.72*		
7. Overestimation errors	0.75	1.07	−.43†	−.37	.19	−.45*	.49*	.33	
8. Group performance[b]	10.50	5.92	.47*	−.15	.07	.15	−.14	−.30	.04

[a] $n = 20$ groups.
[b] Group performance was ranked from 1, "high performance," to 20, "low performance." We reversed the signs on the correlation coefficients above for group performance to make them more intuitive.
† $p < .10$
* $p < .05$
Two-tailed tests.

TABLE 2
Multivariate and Univariate Effects of Starting Times on Group Processes and Outcomes[a]

Variable	Sum of Squares	Error Sum of Squares	MS Means	Error Means	*F*
Time consciousness	72.20	1,230.00	72.20	68.33	1.06
Staging time	414.05	1,506.90	414.05	83.72	4.95*
Time calculations	11.25	53.30	11.25	2.96	3.80†
Temporal imprecision	0.57	2.23	0.57	0.12	4.57*
Overestimation errors	4.05	17.70	4.05	0.98	4.12†
Group performance	145.80	519.20	145.80	28.84	5.06*

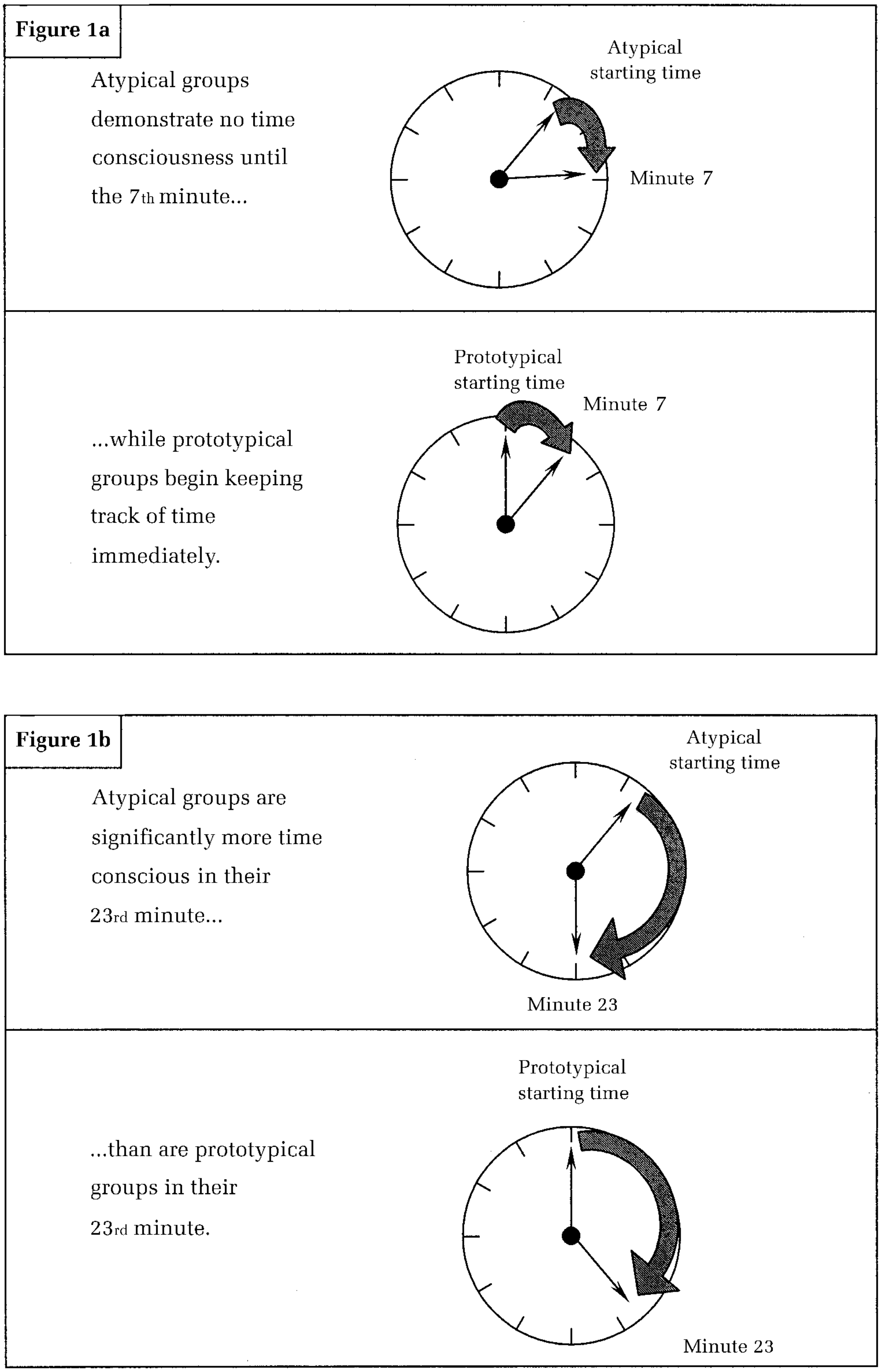
[a] For the multivariate tests, Wilks's lambda = 38; $F_{4,\ 15} = 3.52$.* For the univariate *F*-tests, $df = 1, 18$.
† $p < .10$
* $p < .05$
Two-tailed tests.

amount of time they had remaining was greater than the number of times prototypical groups made those errors ($t_{1,\ 18} = 2.01$, $p < .05$). Thus, both Hypothesis 1 and Hypothesis 2 were supported. A quote from an atypical group member during the debriefing was particularly illustrative in demonstrating the confusion caused by having atypical deadlines: "We actually didn't know whether it would be an hour from when you said, or an hour from like 3:30 or something." Note that the participant dealt with the uncertainty by using a typical, schema-consistent temporal milestone (3:30) as the default, despite specific instructions saying that their deadline was 4:23 p.m., not 4:30 p.m. The atypical groups did not differ significantly from the prototypical groups in their overall level of time consciousness ($t_{1,\ 18} = 1.03$, $p < .28$). However, supporting Hypothesis 2, the groups with atypical deadlines calculated the time remaining to project deadline more often than prototypical groups ($t_{1,\ 18} = 1.95$, $p < .05$).

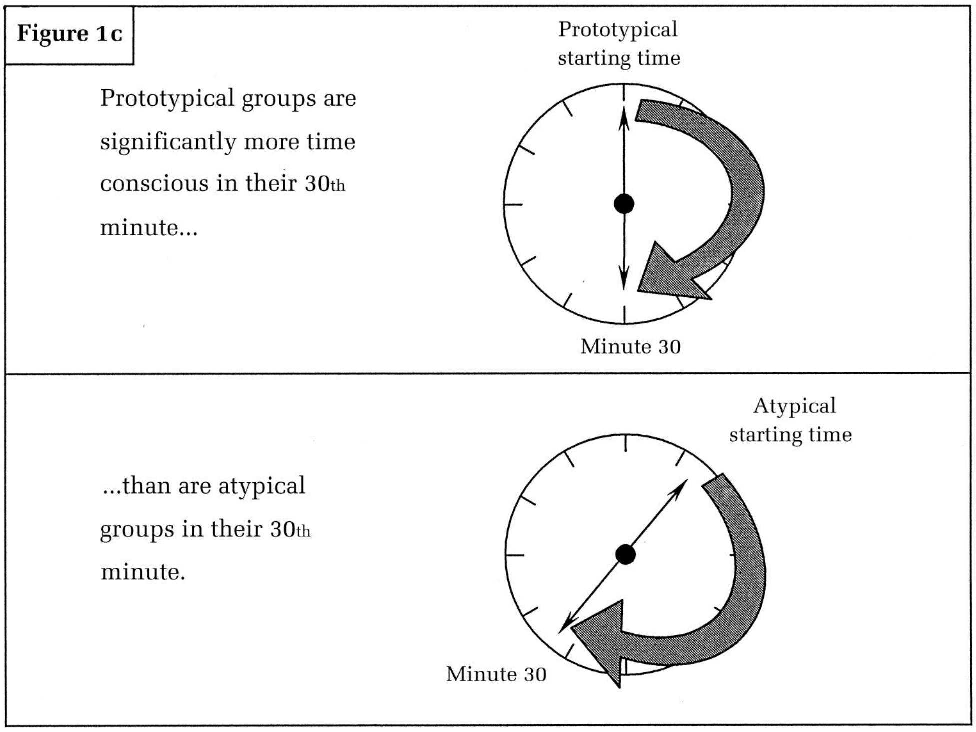
The MANOVA results confirmed that the atypical groups began staging their commercials significantly later than the prototypical groups and spent less time staging their commercials ($F_{1,\ 18} = 2.22$, $p < .05$), supporting Hypothesis 3. The prototypical groups tended to transition around minute 38, while the atypical groups transitioned around the minute 47, leaving them much less time to rehearse their commercials (see Figure 1d). Looking back, the study participants in the atypical groups often mentioned that they had not paced their work well. Following are some responses from their debriefing session to questions about how things had gone:

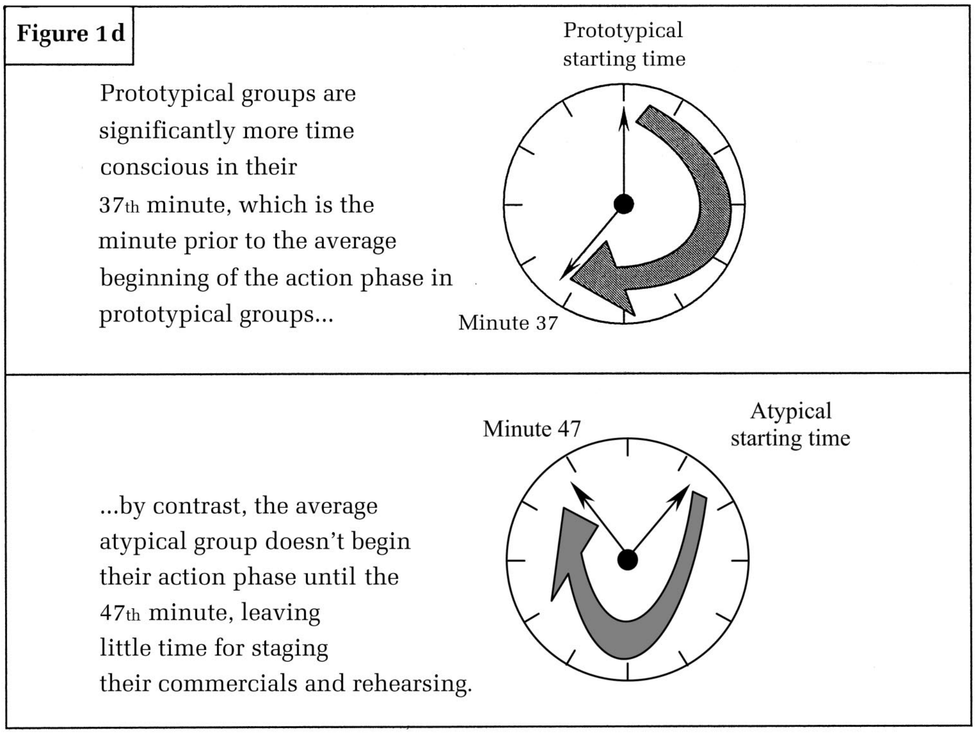
> I think we spent too much time looking through the [Web] site.
>
> We didn't organize our time very well.
>
> Five more minutes was all we needed, and we were like five minutes short.
>
> We were fine on time, except for the last 10 minutes, and then we just scrambled.

FIGURE 1
Clock Time and Differences in Time Consciousness in Atypical and Prototypical Groups



The ultimate result of the atypical deadlines were poorer outcomes for the atypical groups; the advertising executives ranked their commercials significantly lower ($Z = -2.04$, $p < .05$), supporting Hypothesis 4. We also performed a post hoc check to see if there was any difference between the atypical and prototypical groups on the length of their commercials, or on whether they had to be cut





off because of poorly timing their commercial lengths, but there were no significant differences on this point.

Post hoc comparisons of minute-by-minute time statements and time checks in both types of groups also indicate differences between the atypical and prototypical groups in the *timing* of time-conscious statements. Contrasts were significant at minute 12 ($t_{1,18} = 2.06$, $p < .05$), minute 23 ($t_{1,18} = 2.11$, $p < .05$), minute 30 ($t_{1,18} = 2.59$, $p < .05$), minute 37 ($t_{1,18} =$

2.15, $p < .05$), and minute 59 ($t_{1,\ 18} = 2.13$, $p < .05$), with atypical groups showing more time consciousness at minutes 12, 23, and 59, while prototypical groups showed more time consciousness at minutes 30 and 37.

A closer examination of the time consciousness data indicates interesting differences between the prototypical and atypical groups that appear to be coordinated with clock time. In atypical groups, we don't see any time consciousness at all until minute 7, which is when the atypical groups approach the quarter-hour mark (see Figure 1a). Although groups that began at prototypical times were engaging in pacing activities in the first seven minutes, the atypical groups were "lost in time" during those first seven minutes. Then we see a significant difference at minute 23, which is at half-past or quarter-past the hour for the atypical groups (see Figure 1b). Here the atypical groups are checking the time remaining and trying to calculate the time to deadline, but notice that they are using the culturally dominant "half-past the hour" and "quarter-past the hour" milestones to organize their time. By contrast, the prototypical groups are at a nonmilestone minute. The atypical groups do not make the decision to transition from the planning phase to the action phase at this point. The next significant difference is at minute 30, when the prototypical groups reach the half-past the hour or quarter-past the hour milestone; the prototypical groups have significantly higher time consciousness at this point than the atypical groups (see Figure 1c). Finally, the atypical groups have a significantly higher time consciousness at minute 59 than the prototypical groups, in that the atypical groups scrambled to complete staging their commercials and squeezing in any rehearsals that they could before the experimenter came in to begin taping the commercial (see Figure 1d).

STUDY 2

We designed Study 2 with several purposes in mind. First, because Study 1 was conducted at the group level of analysis, we sought to replicate the general pattern of results at the individual level of analysis, intending to provide evidence for generalizing the temporal atypicality phenomenon uncovered in Study 1. Second, a central argument in the hypotheses for Study 1 was that the relationship between lower performance and atypical starting times is attributable to team member problems transitioning from one aspect of a task to another. In the second study, we sought further support for this argument by creating multiple tasks, which allowed us to directly track the relationship between atypical starting times and task transition. By asking participants to actually put down one task and move to a second task, we simulated what group members in Study 1 had to do (e.g., transition from planning to acting in a timely manner) in order to successfully complete their task. The combination of an individual level of analysis and multiple tasks allowed direct exploration into why atypical starting times lead to lower performance through understanding individual pacing, attention, and perceived time pressure.

Hypothesis 5. Individuals with atypical starting times on the first of two tasks transition from their first task to their second task later than individuals with prototypical starting times on the first task.

Hypothesis 6. The performance on the second of two tasks is lower for individuals with atypical starting times for the first task than for individuals with prototypical starting times on the first task.

We argued that the performance decrements found in Study 1 were a consequence of team member's having less time available because they made a late transition from their planning phase to their acting phase. This second study provides further support by testing whether poorer performance on task two is directly attributable to late transitions caused by atypical starting times.

Hypothesis 7. For individuals with atypical starting times on the first of two tasks, the time of transition between the first and the second task mediates the relationship between starting time on the first task and performance on the second task.

One gap in Study 1 was our inability to directly ask participants their views about their time management. In Study 2, we hypothesized and tested several aspects of participants' assessments of their time management in view of findings from Study 1. For example, in study 1, we found that the atypical groups demonstrated no time consciousness until their seventh minute (see Figure 1a). We interpreted this as meaning that the atypical group members were "lost in time" during that early period of their groups' lives. In Study 2, we asked the subjects directly if they had lost track of time during the tasks.

Hypothesis 8. Individuals with atypical starting times on the first of two tasks relate that they lose track of time during the first task more often than do individuals with prototypical starting times on the task.

We argue that participants with atypical starting and ending times will do a poorer job of pacing the transition from the first of two tasks to the second task, and that, in addition to leaving less time for the second task, they will also feel greater time pressure while performing the second task. This, too, will reduce performance on the second task. Participants in Study 1's atypical groups mentioned during debriefing sessions that they felt greater time pressure as the deadline approached, as well as greater time pressure throughout the group's life, and we sought to compare the perceived time pressure across atypical and prototypical conditions in Study 2.

Hypothesis 9. Individuals with atypical starting times on the first of two tasks relate feeling more time pressure during the second task than do individuals with prototypical starting times on the first task.

Hypothesis 10. Individuals with atypical starting times on the first of two tasks relate feeling they had insufficient time to complete both tasks more often than individuals with prototypical starting times on the first task.

Methods

Participants, research design, and task description. Volunteer participants were recruited from a management course taken during the junior and senior years at a private U.S. university. As in Study 1, we used students from the same course and university for the entire experiment; however, none of the participants in Study 2 had been involved in any way with Study 1. All participants were randomly distributed into the various experimental conditions.

Participants arrived in groups of three to the laboratory to be briefed. A research assistant informed them that they were taking part in a study related to creative productivity in work organizations. They were told that the experiment would consist of two related tasks that would take a total of 30 minutes to complete and that a brief questionnaire designed to elicit their reactions to the experiment would follow. The research assistant explained the first task broadly and directed the participants to an envelope on a table that contained the task. The first task consisted of evaluating four independent short scenarios and providing written advice on how to best resolve the dilemma. These dilemmas varied from how to respond to a perceived inequity in rewards within a group, to dealing with a personality conflict within a team. The participants were intentionally provided more scenarios for the first task than would be possible to complete in 15 minutes so that they would be forced to actively manage their time. The researcher emphasized that the performance metric was based on comprehensive and detailed answers (i.e., quantity of output) and that the participants might not be able to complete the first task in the allotted time. The second task consisted of the "brick test" (Guilford's [1967] "alternative uses task") used to assess divergent thinking. The brick test consists of a list of various items, such as a brick, for which the individual is asked to think of alternative uses.

The participants were informed that they should spend an equal amount of time on each task and that they would receive exactly 30 minutes total for both tasks. A sign in large type reminding the participants of the time component of the task was left at each table. At this point the participants were instructed to look at the clock on the wall in front of their tables and told that it was the official time clock. The participants were told that they would work behind closed doors in separate adjoining offices during the experiment and that the principal researcher would be waiting outside the door. Each office was similar to the one that they were in for the briefing, and each had a clock that was identical to the official time clock, with time synchronized to it. The participants were told that the door to each office would remain closed during the experiment, and when they completed the first task they should place their answer in the envelope provided in the office and quietly slide their responses under the door. At that time, the researcher would exchange the completed first task with the second task. The second task was self-explanatory and should be started immediately. The researcher would announce when the 30 minutes had expired, and the participants would immediately cease work on the second task. The researcher would then open the doors and hand each participant the final questionnaire.

We purposely designed the transition between tasks in this manner to avoid any social prompting. That is, if one individual noticed that another individual had completed and handed in the first task, he or she they might then notice the time. Also, the visible work pace of one individual might influence another. Asking the participants to slide their completed tasks under a carpeted door limited social prompting from the noise of an opening and closing adjoining door. It also provided the investigator with the exact timing of the transition from task 1 to task 2.

The experiment was conducted in the evening to minimize distractions, and a principal investigator ensured that the three wall clocks and the official timer were synchronized each evening. No individual had to wait more than 10 minutes to begin the experiment. The participants were informed of the time and told that they should begin and that they had exactly 30 minutes. The researcher then closed each door and waited in the hall.

Independent variable. We manipulated atypical and prototypical *start times* in a way similar to that in Study 1. Participants in the atypical condition began the experiment either eight minutes before or eight minutes after the hour or half-hour point. In the prototypical condition, the participants began either directly on the hour or at half-past the hour.

Dependent variables. The *transition point* was based on the total number of seconds elapsed from when the experiment officially began to when the first task was slid under the door. The investigator recorded the time for each participant. *Performance on task 1* was determined by entering the written responses for the four scenarios onto the computer and counting the total number of words each participant wrote. *Performance on task 2* was a count of the number of unique responses a participant provided.

We also assessed reactions to the two tasks and the overall experiment, including the degree to which an individual either *lost track of time* or was *rushed* in task 1 and task 2, and participants' overall assessments of whether they were rushed in general. The questionnaire explicitly differentiated between task 1 and task 2 and the overall experiment.

With regard to the first task, the participants were asked the degree to which they were "rushed to complete the first set of tasks" and whether "there was enough time to complete the first set of tasks" ($\alpha = .79$). They were also asked to what degree they "lost track of time while trying to complete the first set of tasks" and whether they "managed [my] time effectively in completion of the first set of tasks ($\alpha = .75$)." We asked the same questions, replacing the word "first" with "second" for the second task (feelings of being rushed, $\alpha = .85$; effective time management, $\alpha = .55$). Finally, we asked the participants to consider the tasks in their entirety and to assess these two statements: "There was enough time in the two sets of tasks to tap my creativity" and "I felt that the two sets of tasks allowed me enough time to exhibit my level of creativity" ($\alpha = .83$).

Results

Table 3 gives the means, standard deviations, and correlation matrix for the variables in Study 2. We performed regression analyses to test all the hypotheses; results are in Table 4.

Hypothesis 5 states that individuals starting the first of two sequential tasks at atypical times transition from their first task to their second task later than individuals starting at prototypical times. The regression of transition time on starting time was statistically significant in the predicted direction ($t_{1,\ 71} = 2.71$, $p < .01$, supporting Hypothesis 5. Hypothesis 6 predicts lower performance on the second task for individuals with atypical starting times than for individuals with prototypical starting times. The regression of task 2 performance on starting time was also statistically significant in the predicted direction ($t_{1,\ 71} = -1.95$, $p < .05$), supporting Hypothesis 6. One alternative explanation for the relationships posited in Hypotheses 5 and 6 is that extra time spent on task 1 led to a trade-off whereby the individuals with the atypical starting times performed better on task 1 than those in the prototypical conditions. We conducted a post hoc

TABLE 3
Bivariate Correlations, Means, and Standard Deviations for Study 2[a]

	Mean	s.d.	1	2	3	4	5	6	7	8
1. Starting time	0.47	0.50								
2. Transition point	1,058.56	233.24	.31*							
3. Task 1 rushed	7.35	3.25	.06	.10						
4. Task 1 time management	5.82	23.00	.21†	.49*	.26*					
5. Task 1 performance	329.61	67.75	.17	.63*	.06	.24*				
6. Task 2 rushed	7.51	4.02	.27*	.61*	−.01	.34*	.44*			
7. Task 2 time mgmt.	6.14	2.97	.07	.47*	−.22†	.32*	.39*	.57*		
8. Task 2 performance	27.56	10.92	−.22†	−.74*	.07	−.30*	−.41*	−.43*	−.36*	
9. Overall time	8.64	2.73	−.31*	−.45*	−.25*	−.26*	−.12	−.41*	−.28*	.29*

[a] $n = 73$ participants.
† $p < .10$
* $p < .05$
Two-tailed tests.

TABLE 4
Results of Parallel Regression Analyses for Time Atypicality, Study 2[a]

Independent Variable	β	ΔR^2
1. Time spent on task 1	.31*	.09*
2. Performance on task 2	−.23*	.05*
3. Lost track of time on task 1	.21*	.04*
4. Felt time pressure on task 2	.27*	.07*
5. Had enough time overall?	−.31*	.10*

[a] $n = 73$ participants.
* $p < .05$
One-tailed test.

regression to rule out this possibility and found no relationship between performance on task 1 and starting time ($t_{1,\ 71} = 1.23$, n.s).

Hypothesis 7 predicts that the time of the transition between task 1 and task 2 mediates the relationship between starting time and performance on the second task for individuals with atypical starting times: later transitions from task 1 to task 2 would lead to poorer performance on task 2. Testing mediation is a multistep process (Baron & Kenny, 1986). We found support for the first step in the results for Hypothesis 5. In the second step, the dependent variable was regressed on the independent variable, which was supported by Hypothesis 6. In the final step, the dependent variable was regressed on both the independent variable and the mediator. We found that although transition time remained a significant predictor of task 2 performance ($t_{1,\ 71}$ = -8.67, $p < .05$), for step 1, the influence of starting time became nonsignificant ($t_{1,\ 71}$ = .01, n.s.) when regressed simultaneously with transition time. Taken together, these analyses suggest support for the fully mediated relationship described in Hypothesis 7. Hypothesis 8 predicts that individuals with atypical starting times will relate that they lost track of time on the first task. We found support for Hypothesis 8 ($t_{1,\ 70} = 1.80$, $p < .05$). Hypothesis 9 predicts that individuals with atypical starting times would be more likely to relate that they felt time pressure during the second task than individuals with prototypical starting times. We found support for Hypothesis 9 as well ($t_{1,\ 70} = 2.33$, $p < .05$). Hypothesis 10 predicts that individuals with atypical starting times would relate that they felt that there was insufficient time to complete both tasks. We found support for Hypothesis 10 also ($t_{1,\ 70} = 2.71$, $p < .05$).

DISCUSSION

Time is a relative, subjective, culturally bound phenomenon that is perceived, interpreted, and organized through cognitive schemata. While numerous group and organization-level input variables (e.g., group composition, structure, task, organizational resources, and structure) have been found to affect group processes and outcomes (e.g., Fleishman & Zaccaro, 1992; Guzzo & Shea, 1992; Levine & Moreland, 1990), little empirical research has focused on temporal inputs, despite the importance of time in organizations (Kelly, 1988).

We conducted two experiments in which participants were given the same objective amount of time to complete a project, but the starting times were manipulated to be more or less prototypical of our culturally entrained temporal schemata. In Study 1, groups that began their tasks at atypical times left themselves less time to properly perform all phases of their task adequately, created more time pressure for themselves, and ultimately created poorer- quality output than groups beginning their tasks at prototypical, culturally entrained milestones. In the second study, conducted at the individual level, we replicated the central finding of Study 1 in that atypical starting times had negative performance implications. We also extended the findings from Study 1 by finding evidence that individuals with atypical starting times experienced less time to devote to a later task, temporal imprecision, and increased perceptions of time pressure when compared with individuals provided the *exact* same amount of time but starting at prototypical times. All of these factors contributed negatively to performance on the second task for those in the atypical condition, and we didn't observe an increase in performance on the first task. The subjects were "lost in time."

These results suggest that it might be important to focus research attention on these external, culturally entrained milestones as well as on internal midpoints. Interestingly, in the original laboratory study conducted by Gersick (1989), she indicated that she had all of her experimental groups arrive on the hour. Our results suggest that the midpoint transition that she observed might have been accounted for by the groups reaching the half-past the hour or quarter-to the hour milestone, rather than by their reaching the midpoint of their life spans. Our studies replicated that aspect of her results: in the groups that began at prototypical times, the exact midpoint of their existence (minute 30) was indeed a time of greater time consciousness. However, in the groups that began at atypical times, there was significantly more time consciousness at minute 23, which is when those groups hit the culturally entrained milestones of half- or quarter-past an hour. This finding suggests a need to pay closer attention to these cultural temporal institutions.

An interesting result from our studies was that transitions to new stages of work (an action versus planning stage in Study 1, and a second task in Study 2) in atypical conditions occurred later, rather than earlier. That is, if the midpoint of the time allotted for work fell at 4:23, participants could have reset their mental stopwatches on either 4:15 or 4:30, and one would thus expect an even distribution between early and late transitioning. The fact that this did not occur suggests that the individuals and groups did not plan their pacing at the beginning, make a decision to transition early, and then intentionally speed up their pace through the early phase of their task to ensure an early transition. It appears that they set their internal stopwatches back and acted as if they had more time than they did. We have shown that pattern empirically with the differences in time overestimation that they made. We also have the strong behavioral indication that this happened because the average prototypical groups in Study 1 transitioned to their action phase, staging their commercials, at the 38th minute of their life spans, while the atypical groups waited until their 47th minute. What we observed in both studies is that these groups and individuals dealt with transitions in an *emergent* fashion. That is, they begin working at some natural pace, and along the way, they decided it was time to transition to the next phase of the task. That didn't happen early because they would have needed to plan for the transition to occur at the beginning and stuck to that plan throughout the task. The results of the second experiment are stark in supporting this. In the second experiment, we explicitly told participants prior to the beginning of the tasks to pace themselves so that they would spend half their time on task 1 and half their time on task 2. In fact, we placed signs in large type on their otherwise empty desks reminding them that they had 30 minutes and should spend an equal amount of time on each task. Yet when the tasks began, the participants with atypical deadlines still were not able to transition at the appropriate time. That suggests that the transitions are dynamic and emergent, rather than statically defined at the beginning of tasks.

One goal of this type of research is to provide team leaders a better understanding of how starting times and ending times might influence both individual and group processes and outputs. Future research needs to replicate the temporal atypicality phenomenon and negative performance effects demonstrated here and extend examination to other factors that might affect the phenomenon. For example, the time clock used in this study is just one aspect of the temporal environment to which organizational teams can entrain. Will this phenomenon be replicated when we look at team deadlines that are entrained to the weekly and monthly calendar, an organization's fiscal cycle, and industry business cycles (Ancona & Chong, 1996)? These other calendars and cycles will also have prototypical and atypical moments, and it would be interesting to see if our results hold with projects of longer duration. Although generalizability is always an issue with laboratory experiments, the fact that Gersick's work with these same types of task groups was tested in both long-term field teams (1988) as well as short-lived laboratory teams (1989) offers hope that these results might generalize beyond the short-term lab setting and to some of these longer-term aspects of the temporal environment.

Another factor that might influence the temporal atypicality phenomenon is task complexity. Our study used moderately complex tasks that required a good deal of cognitive effort. If atypical deadlines lead to lower performance through cognitive distraction, we might not expect simpler tasks to generate this same phenomenon because they require less cognitive effort. Another possibility is to examine timed performance on creative tasks that require subjects to slip into a "timeless" state to produce creative results (Mainemelis, 2001). Will the apparent consequences of temporal atypicality—poorer storing in memory of deadlines, poorer retrieval of deadlines, increased time distraction, and increased time consciousness—lead to worse creative performance when time is of the essence?

To date, research on time and groups has focused on externally imposed deadlines but has taken little account of the broader cultural context in which these deadlines are embedded. Different cultures have different cultural rhythms (e.g., Levine, 1988), and it would be interesting to incorporate these different norms and expectations into the study design presented here. For example, German culture is renowned for temporal precision. A cross-cultural comparison might find that a team of Germans might not fall victim to the same problems that American teams had when starting times were manipulated. Similarly, industries might have different temporal rhythms (for instance, Wall Street's financial industry is known for having a much faster pace than other settings) that might lead to different reactions to deadlines. Further research taking cultural time orientation at the national, regional, and industry levels into consideration would make for an interesting extension of this work. We expect that as companies make greater use of multinational teams composed of members who have radically different cultural time orientations and who are scattered across different time zones, the possibility that temporal differences will affect group process will only continue to increase. Because temporal schemata are culture-bound (e.g., the Muslim workweek begins on Sunday, while the Christian workweek begins on Monday), different societies will evaluate what is prototypical and what is atypical differently. When people are placed in global teams, such differences will create natural pacing schemes that are not "in phase" with each other, and we expect this phenomenon to impact the dynamics and effectiveness of these teams.

Another direction for future research concerns understanding how individual time orientations affect a group's temporal schema. Our first study was conducted at the group level of analysis. The focus was on understanding how a group as a whole dealt with a prototypical or atypical deadline. However, much of the recent conceptual work on temporal perception has been primarily focused on individual team members, rather than whole groups (e.g., Blount & Janicik, 2001). Employing a meso perspective (House, Rousseau, & Thomas-Hunt, 1995) that combines understanding individual differences with studying groups as a whole might prove fruitful for advancing understanding of temporal effects in groups and organizations (see Waller et al. [2002] for a recent example). For example, understanding possible group composition effects stemming from group members having different time orientations (Waller et al., 2001) to see if they affect the temporal atypicality phenomenon found in this study would be an interesting future research path.

The study has a number of limitations that can guide future researchers to improve the study of the temporal atypicality phenomenon. Study 1's performance measure was a vague, subjective measure: practitioners assessed the suitability and potential effectiveness at changing consumer behavior of scripts for commercials. A more precise performance measure that taps into other facets of performance, including, for example, creativity and spontaneity, might show that temporal atypicality has contingent effects on performance. We would also like to call future researchers' attention to an alternative hypothesis to temporal atypicality; it is possible that starting times that end in zero (e.g., 4:00 p.m., 4:30 p.m.), as did some of the starting times in our studies, lead to greater ease in subjects calculating the time remaining for tasks. However, when we compared the performance of prototypical teams that began at times like 4:15 and 4:45 with the performance of those beginning at times ending in zero, we did not find significant differences. Regardless, future replications having all prototypical deadlines end on the quarter-hour milestones will eliminate this alternative hypothesis entirely.

Given the dramatic increase in the use of teams in the workplace, it is vital that researchers understand how their context affects their processes and their outputs. The temporal context is particularly important to understand because it is so pervasive, yet so easily ignored. It makes sense that good timing is key to good team leadership, but a more precise understanding of what "good timing" entails is needed. We hope this study is a step toward developing better project timing. In a broader sense, this study is also a call for further research on how people manage and divide their attention between focusing on task substance and focusing on orchestrating their efforts, and further research on how individuals and groups pace their work, in terms of both their internal cognition and coordination of their efforts with the demands of their environment.

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