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Leslie PERLOW, *Harvard Business School*.

- Finally a masterful book about time. Bluedorn's work is comprehensive and cutting edge, laying out the interplay of time with fundamental aspects of organizations and individuals. It should be on every serious organizational scholar's bookshelf.

Kathleen El sen hardt, *Department of Management Science and Engineering, Stanford University*
Coauthor of *Competing on the Edge: Strategy as Structured Chaos*

- This is a wonderful and important book, full of fascinating information, insights, conjectures, and constructs. Bluedorn forges a compelling case for the importance of time, and of our roles as current stewards of the temporal commons. From the Big Bang to the Bolshevik revolution to the puzzles of Deep Time, from the social construction of zero to the theory of relativity, from the gates of Trenton State Prison to the gates of Dante's Inferno, *The Human Organization of Time* weaves a compelling fabric of temporal threads. Bluedorn has found power and poetry in time.

ramón aldag, *Department of Management and Human Resources, University of Wisconsin*

- *The Human Organization of Time* is a broad look at how we truly think about time. It unifies the many human patterns of time-scale concepts and gives depth and perspective to a complex field. Thorough and insightful, it will become the standard work.

Gregory benford, *Department of Physics, University of California, Irvine*
Author of *Deep Time*

- *The Human Organization of Time* stands to be a definitive source for those interested in temporality and time. Bluedorn's knowledge of diverse literatures and his attention both to historical perspectives as well as contemporary theorizing and research is noteworthy. Issues of time and temporality pervade the human experience; Bluedorn helps us to appreciate temporality as a social construction with very real consequences for organizations and their members.

jennifer M. george, *Jesse H. Jones Graduate School of Management, Rice University*

- A remarkable and original contribution to our understanding of the social construction of time and its effects on people and organizations. Playing off against a backdrop of work preoccupied with enduring and stable features of social life, Bluedorn underscores the importance of temporal features—pace, tempo, rhythm, entrainment, and historical turning points.

alan meyer, *Lundquist College of Business, University of Oregon*

The Human Organization of Time

TEMPORAL REALITIES AND EXPERIENCE

Allen C. Bluedorn

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To those who have brought such exquisite meaning to my times;
may their times be the best of times always:

To my wife, Betty;

To my sons, John and Nick;

To my brother, Ralph;

To my mother, Evelyn;

To my father, Rudolph, 1905—1988.

Convergence

Tempori aptari decet.

(The right thing is to fit the times.)

—Seneca, *Medea*

For decades the guards at Trenton State Prison, New Jersey, began their eight-hour shifts at 6:20 A.M., 2:20 P.M., and 10:20 P.M. They did so because the trolley would stop near the prison at about these same times (Hirsch 2000, p. 87). Both the prison and the trolley system had schedules, and the convergence of the two schedules worked to their mutual advantage. The prison benefited by having its workforce arrive reliably at the set times, and the trolley system benefited by having a loyal and regular clientele.

Schedules are rhythmic templates, and rhythms are one way times differ. Indeed, recurring schedules might well be defined as templates for rhythms because they prescribe behavior in terms of patterned repetition. Just as the sheet music provides a template for playing the tune, the schedule in the workplace for behaviors such as the arrival times of prison guards similarly provides a template for performing work. Through daily repetition, the schedule imparts a rhythm to the lives of individual workers as well as to the organization as a whole. To some extent any schedule will impart a kind of protorhythm to the day's activities, but when the schedule is repeated day after day, a genuine rhythm emerges, a repetitive pattern of behavior.

These emergent rhythms vary in important ways, such as their speed and phase patterns, and these differences must be accommodated to successfully

coordinate the phenomena displaying them. Such phenomena are the subject matter of this chapter, specifically, How do rhythms differ? How can phenomena displaying different rhythms be integrated? What happens when such integration occurs? Is such integration necessarily a good thing? And "good" from whose perspective? To explore these questions the concept of entrainment will be introduced and used extensively.

ENTRAINMENT

In one of those scientific coincidences that may reflect a widespread concern with the same general questions, the concept of entrainment was first employed in social and behavioral science analyses in 1983, and by researchers from very different homes in the social science community. One investigator was Edward Hall (1983), whose work on polychronicity was discussed extensively in Chapter 3. The other investigators were Joseph McGrath and Nancy Rotchford (1983), and their work, along with subsequent investigations conducted by McGrath and Janice Kelly will inform important discussions later in this chapter.

These investigators' simultaneous introduction of entrainment into the social sciences is itself ironic, given what entrainment is. Entrainment is about rhythmic phenomena and the possibility that their rhythms may converge. So, were the rhythms of anthropology (Hall) somehow convergent with those of social psychology (McGrath and Rotchford), resulting in the simultaneous introduction of the entrainment concept in 1983? This would be tricky to determine, but the idea that rhythmic patterns come into alignment and then behave in a parallel fashion describes the essence of entrainment.

Such may be the essence of entrainment, but this does not describe its agency, for as McGrath and Rotchford explained, not only do rhythms come to oscillate together, but one rhythm is often more powerful and captures the other rhythm (1983, p. 62). The less powerful rhythm is captured and adjusts to the rhythm of the more powerful. So in the case of entrainment between the shift schedules at Trenton State Prison and the city's trolley schedules, the trolley schedules acted as the entrainer, the behavioral oscillation that captured the rhythm of the shift schedule. At least this is James Hirsch's conclusion, albeit not phrased in entrainment terminology: The trolley schedule "dictated the prison schedule" (Hirsch 2000, p. 87), and "dictated" sounds a lot like a

reference to the dominant rhythm in this situation, the rhythm that is doing the entraining.

So entrainment is the process in which the rhythms displayed by two or more phenomena become synchronized, with one of the rhythms often being more powerful or dominant and capturing the rhythm of the other. This does not mean, however, that the rhythmic patterns will coincide or overlap exactly; instead, it means the patterns will maintain a *consistent relationship* with each other. The consistent relationship could be an exact overlap, but it could also be that one pattern will consistently lag or lead the other. For example, the shift schedule at Trenton State Prison likely *lagged* or followed the trolley schedule by a few minutes. That is, the shift would have been scheduled to begin a few minutes *after* the trolley arrived. If the two rhythms had overlapped exactly (synchronously), that is, if the shifts had been scheduled to begin at exactly the same time that the trolley arrived, the arriving guards would always have been a few minutes late for their shift. Both patterns—an exactly synchronous overlap and what was probably the actual pattern, one in which the entrained rhythm (the work-shift schedule) lagged the entraining rhythm—represent entrainment. The difference is only in the way the two patterns are related consistently and repetitively.

If two rhythmic patterns are related consistently, which is to say, if they are entrained, this relationship can be described precisely in mathematical terms as maintaining a distinct phase-angle difference between the two rhythmic patterns (Aschoff 1979, pp. 5-6).¹ So the mathematical definition of perfect entrainment would be when the phase-angle difference between two rhythms is constant throughout a complete cycle of each rhythm. When the rhythms overlap exactly, the phase-angle difference is zero (as would be the case if the trolley arrival times and shift starting times were identical). When the entrained rhythm lags the capturing or driving rhythm in its phase (e.g., if the shift schedule's phase were to follow the trolley's), the phase-angle difference is negative; and when the entrained rhythm leads or precedes the driving rhythm, the phase-angle difference is positive (Aschoff 1979, p. 5-6). In the case of the trolley-shift example, this would mean the shifts would have been scheduled to begin *before* the trolley was scheduled to arrive, if for some reason the prison's managers had been foolish enough to create such absurd schedules. In all three cases, if the two rhythms were perfectly entrained, the *difference* in these two times (trolley arrivals and beginning of shifts) would be

TABLE 6.1

Possible entrainment relationships.

Type of entrainment relationship	Description	Example
Lagging (negative phase-angle differences)	The phases of the entrained rhythm <i>follow</i> the corresponding phases of the entraining rhythm.	The bus arrives at 5:00 A.M., 1:00 P.M., and 9:00 P.M. (the <i>entraining</i> rhythm), and the work shifts at a nearby company begin daily at 5:30 A.M., 1:30 P.M., and 9:30 P.M. (the <i>entrained</i> rhythm).
Synchronous (no phase-angle differences)	The phases of the two rhythms occur <i>at the same time</i> .	The bus arrives at 5:00 A.M., 1:00 P.M., and 9:00 P.M. (the <i>entraining</i> rhythm), and the work shifts at a nearby company begin daily at 5:00 A.M., 1:00 P.M., and 9:00 P.M. (the <i>entrained</i> rhythm).
Leading (positive phase-angle differences)	The phases of the entrained rhythm occur <i>before</i> the corresponding phases of the entraining rhythm.	The bus arrives at 5:00 A.M., 1:00 P.M., and 9:00 P.M. (the <i>entraining</i> rhythm), and the work shifts at a nearby company begin daily at 4:30 A.M., 12:30 P.M., and 8:30 P.M. (the <i>entrained</i> rhythm).
Independent (random phase-angle differences)	<i>No correlation</i> between the two rhythms' corresponding phases.	Daily random fluctuations between the bus and work-shift schedules.

note: The labels for the "lagging" and "leading" types of entrainment relationships were taken from Aschoff's definitions of positive and negative phase angles, respectively (see Aschoff 1979, pp. 5-6, and the text). Also, what I label "synchronous" entrainment, Ancona and Chong called "synchronic" entrainment (1996, p. 258). The example of a lagging entrainment relationship is a more contemporary and generic version of the example in the text, which was based on Hirsch's (2000, p. 87) description of work shifts at the Trenton State Prison. The example in the text was likely an example of a lagging entrainment relationship, because the work shifts at the prison (the *entrained* rhythm) would probably have started a few minutes *after* the trolley stopped near the prison (the *entraining* rhythm).

constant for the phases throughout the twenty-four-hour periods of both rhythms. These three possibilities and a fourth, no entrainment, are summarized in Table 6.1.

The details of rhythmic oscillating phenomena, their depiction in the form of sine wave-like figures, and how two such waves can be related through entrainment can be found in a variety of sources (e.g., Ancona and Chong 1996; Aschoff 1965, 1979; Pittendrigh 1981). But the four possibilities summarized in the preceding discussion and in Table 6.1 provide a sufficient conceptual base for examining the convergence of rhythms displayed by social phenomena—if this conceptual base is joined by a few additional considerations.

Zeitgebers

Zeitgeber is now officially an English word, pronounced “tsite-gaber,” (see both *Merriam-Webster's Collegiate Dictionary*, 10th ed., and the *Oxford English Dictionary*, 2nd ed.), but it originated as a German word literally meaning *time (zeit) giver (geber)*. In the context of entrainment, the term is often used in the sense of a pacing agent or synchronizer (Ancona and Chong 1996, p. 253; Whitrow 1980, p. 142), which makes a *Zeitgeber* the entraining force, the rhythm that captures another rhythm. (More precisely, Whitrow and Ancona and Chong used the terms *signal* and *cues*, respectively, in their descriptions of *Zeitgebers*, thereby identifying the signals and cues as the *Zeitgebers* rather than the entities that produce the signals and cues. However, owing to a concern for felicitous prose, I will not explicitly make this distinction in my subsequent use of *Zeitgeber*.) An everyday example of a *Zeitgeber* occurs literally every day: the two-phase cycle of lightness and darkness that has been repeated so many billions of times throughout the earth's history. Throughout this four-and-one-half-billion-or-more-year history, untold physical, biological, and social rhythms have become entrained to this fundamental cycle. And human rhythms are no exception to this ubiquitous entrainment to the fundamental cycle, a point that will be examined shortly.

So a *Zeitgeber* is a rhythm external to the system whose rhythm is being entrained to the *Zeitgebers*. And these rhythms have two properties that must be aligned for entrainment to occur. These properties are the speed and phase pattern of the rhythms.

Deborah Ancona and Chee-Leong Chong defined entrainment as “the adjustment of the pace or cycle of an activity to match or synchronize with that

of another activity” (1996, p. 253). And as such, their analysis indicated that a *Zeitgeber* may influence either or both of these two properties of any activity (the cycle properly being the *pattern* of phases exhibited within a single cycle such as the bus-arrival and the work-shift phase patterns in Table 6.1). This is a major departure from traditional analyses of entrainment, which more or less assumed similar speeds of the rhythms involved, an assumption revealed in Aschoff's conclusion: “A self-sustaining oscillation [rhythm] can be entrained by a *Zeitgeber* only to those frequencies that do not deviate too much from its own natural frequency” (1979, p. 6), albeit entrainment can possibly also occur around “multiples and submultiples of the natural frequency” (1979, p. 6; see also Pittendrigh 1981, p. 106, and Wever 1965, pp. 53-54). Indeed, in traditional entrainment theory, entrainment to a *Zeitgeber* “means that the phase of the entrained oscillation is corrected at least once during each period” (Aschoff 1979, p. 6). Thus in traditional entrainment research the issue was basically what Ancona and Chong classified as phase entrainment, aligning and adjusting the phase patterns of two rhythms operating with the same or similar frequencies. Therefore, Ancona and Chong's description of a qualitatively distinct form of entrainment, what they label tempo entrainment (the pace or speed of an activity) is a major extension of the entrainment concept. And given the assumptions of the traditional work on entrainment, tempo entrainment would appear to be a necessary condition, perhaps a boundary condition, for phase entrainment to occur. As several examples will show, *Zeitgebers* can influence both phase patterns and the speed of rhythms.

In Search of Zeitgebers

Zeitgebers organize human life, and organizational life is no exception. Thus examples of *Zeitgebers* entraining organizational rhythms should be plentiful in organizational contexts, and they are. For example, one of the foundation studies in organization science is Paul Lawrence and Jay Lorsch's (1967) study of organizations and their environments. Building on Burns and Stalker's (1961) classic study, Lawrence and Lorsch extended the field's understanding of how environments affect organizations. And one of the ways they discovered was through entrainment, albeit they did not describe the mechanism within this conceptual frame.

What Lawrence and Lorsch discovered and conceptualized was the time span of feedback (sometimes they use the longer phrase “time span of defini-

tive feedback" (1967, p. 28), which is the length of time it takes for decision makers to learn about the consequences of actions (pp. 24-29, 94-95). They found that this time varied systematically by organizational activity, that the time it took for managers in the marketing department to learn about the consequences of their decisions was far shorter than the time it took their counterparts in research and development to receive similar feedback. Not that such times were invariant for managers in each functional area, nor should one expect them to be, a point suggested in work on biological entrainment. Writing in reference to biological rhythms, Colin Pittendrigh and Victor Bruce concluded, "No biological rhythms are strictly periodic in the mathematical sense, and in practice one takes some arbitrary and well-defined statistic of the rhythm as a measure of the periodically repeated events" (1959, p. 483). Thus one would expect social rhythms to vary too.

What makes all of this relevant to a discussion of entrainment is that the time span of feedback was systematically related to the future temporal depths (see Chapter 5) found in different departments (Lawrence and Lorsch varying referred to what I have labeled future temporal depth as either "time orientation" or "time horizons" [1967, pp. 94-95]). The longer the time span of feedback, the longer the department's future temporal depth, meaning the longer it took to learn the outcomes of decisions, the further into the future people in the department tended to look. Hence future temporal depths were entrained to the speed with which the relevant environment provided feedback about decisions, making this attribute of the environment the Zeitgeber. This seems like a specific case of Michael Hay and Jean-Claude Usunier's proposition that the time horizons of key constituents generally have powerful impacts on corporations' time horizons (1993, pp. 324-27).

But temporal depths do more than entrain to their environments; they entrain to each other as well. I first suggested this interpretation as an explanation of the positive correlation between past and future temporal depths (Bluedorn 2000e). And given the consistent set of positive correlations between past and future reported for the individual level in Chapter 5 and the Appendix, and a similar positive correlation at the organizational level (Bluedorn and Ferris 2000), this entrainment pattern seems consistent. Thinking of each temporal depth as a single period, the two periods—past depth and future depth—are consistently aligned, hence entrained, and the past depth appears to be the Zeitgeber. For, as described in Chapter 5, El Sawy's (1983) research strongly indi-

cated that the length of past depth influences the length of the future depth, but not vice versa.

Another Zeitgeber for organizational rhythms is the fiscal year, and as Ancona and Chong noted, fiscal years are especially powerful pacers for many organizational activities (1996, p. 253). What they did not note is that the fiscal year itself is often entrained to other rhythms, the rhythms of the annual business cycle. This is suggested in the description of fiscal years presented in Chapter 1, which indicated that fiscal years were originally scheduled to end during periods of slow business activity, thus affording companies the time to perform the required accounting tasks. In entrainment terms, this means the phase patterns of the fiscal year and the business cycle were aligned, with the pattern of annual business activity being the capturing force, the Zeitgeber. And because the fiscal year had to be scheduled in advance, such attempts to schedule the fiscal year to end when companies believed business activity would be slow indicates that annual cycles existed in the business cycle and were perceivable by the people in the companies who scheduled the fiscal years.

Examples of similar attempts to deliberately entrain rhythms to the organization's advantage are easy to detect once one adopts the entrainment lens. Thus earlier analyses (Bluedorn and Denhardt 1988) described how manufacturing companies in the former Soviet Union seemed to have aligned their rhythms to each other, thereby creating a ubiquitous and curious production pattern known as "storming" (a repeating production cycle in which little is produced in the early phases of the cycle, a bit more in the middle phases, and most of what is produced in the entire cycle is produced during the cycle's final phases; see Berliner 1970).

Storming primarily involves phase entrainment, but organizational environments can serve as the Zeitgebers for tempo entrainment too. For example, conditions of hyperinflation in Brazil forced Brazilian companies to adopt electronic banking in order to transfer funds hourly. Otherwise, the high inflation rate would have diminished the value of payments received earlier in the day if companies waited to make a single transfer at the end of the day (McCartney and Friedland 1995, p. A8). In this case the speed with which the value of money was changing (diminishing) in the environment acted as a Zeitgeber to increase the speed with which companies deposited payments.

Although environmental rhythms and tempos are usually more powerful, hence performing the capturing Zeitgeber role, sometimes organizations, singly

or in concert, will capture or adjust environmental rhythms. This happened in Missouri during the 1980s when the lobbying efforts of the state's tourism industry nudged the summer tourist and school vacation seasons closer to synchronous alignment (Bluedorn and Denhardt 1988; Ganey 1983; Lindecke 1983). And it happened for all of the United States in the mid-1980s when the Daylight Savings Time coalition successfully lobbied the U.S. Congress to shift the onset of daylight saving time to the first Sunday in April. The members of this lobbying group were companies such as fast-food chains, greenhouses, and sporting goods manufacturers, all of whom believed shifting that hour of daylight from the morning to the evening for several additional weeks would enhance their sales—and Congress went along with them (Varadara-jan, Clark, and Pride 1992, p. 44). Karl Weick interpreted these actions as manipulations that created an environment which made more sense to the people in these businesses (1995, p. 165). It would certainly make more economic sense to them because their hours of operation would be aligned, that is, entrained more closely, to the preferred shopping phases in their customers' activity cycles.

Vacation seasons, production cycles, and fiscal years all have end points, and end points are deadlines. Deadlines have powerful motivational effects on human behavior (Locke and Latham 1990), often becoming Swords of Damocles hanging over the heads of individuals and organizations alike as people press and strain to complete their activities as deadlines draw ominously near. As deadlines approach, activity on deadline-relevant tasks increases, speeds up (Bluedorn and Denhardt 1988), meaning that deadlines operate as Zeitgebers influencing the speed or tempo aspect of entrainment. And as Connie Gersick's (1988, 1989) benchmark research showed (see Chapter 4), groups reveal distinctive phase patterns, often remarkably consistent phase patterns, *if* they are working on projects with explicit deadlines, albeit alternative mechanisms responsible for these phase patterns have been proposed (cf., Lim and Murningham 1994; Seers and Woodruff 1997). But regardless of the details of the mechanisms producing the phase patterns within these groups, the key point is that these patterns seem to be a response to the deadline, which means deadlines also affect the phase pattern component of entrainment in groups, and likely the phase patterns of individuals too.

As these examples indicate, individuals and groups both entrain to Zeitgebers, and sometimes the Zeitgebers power to entrain is very widespread.

Pervasive Entrainment

The daily cycle of lightness and darkness may be the most powerful and pervasive Zeitgeber for life on the surface of our planet. It certainly has been for humanity, the hominids, throughout most of our lineage's history. In a manner eerily reminiscent of an early definition of a deadline—"A line drawn around a military prison, beyond which a prisoner is liable to be shot down" (*Oxford English Dictionary*, 2nd ed.)—this daily cycle provided a temporal deadline, a portion of this period within which a hominid, especially a solitary hominid, would be likely to be, not "shot down," but simply unwillingly consumed (see Chapter 2).

Hominids, including the contemporary version, function poorly after the sun goes down, and really the only way we can function well after sunset is to use artificial suns to transform portions of night into day. (Admittedly, a full moon on a clear night would allow for some limited activities.) And despite the use of other forms of artificial lighting, primarily electricity-based forms, which permitted "the colonization of night," Murray Melbin's (1987, p. 10) wonderful metaphor, the daily cycle of light and dark is still pervasive and may still be the most pervasive Zeitgeber in human life. This pervasiveness is revealed by how so many activities are still entrained to be performed during the daylight phase of this twenty-four-hour cycle. To illustrate this point, I will use an example from my professional life.

During the late 1980s, the MBA program at my university decided to move some of its classes to the evening in the hopes of attracting to the program students who worked during the day (note the entrainment to daytime activities of the prospective students). Now, as far as journeys into the night go, this effort was not a daring incursion, because it dealt with only the earliest part of the night. (When Melbin studied nighttime activities, he focused on the period from midnight until 7:30 A.M. [1987, p. 30], what might be called the deep night.) Nevertheless, even the early portion of the night proved to be a very different time than time during the day. (All times . . .)

I was involved with this experiment for several semesters before it was abandoned. During that time my classes began around 6:00 P.M. and would end around 7:30 P.M.—very early night as I said. But just as Melbin described for expeditions into the night generally, support services not only diminished or broke down, they were occasionally even worse than nonexistent. For on at

least two occasions custodians entered my class *during* class and began to clean the room!

After this happened the first time, I reported the events to my chair and dean, who contacted the appropriate people in the central university administration to deal with this problem. We learned that information about my class had somehow not been added to key scheduling forms the university maintained, and that the problem would be taken care of. Unfortunately, the same thing happened at my next class. And this time the custodians called the university police. When they arrived I had to show them my university identification card and justify our presence in the room. Fortunately, after a series of additional conversations with university administrators, the custodians and constables stopped their disruptive visits to my classes.

The custodians and university police officers had been trying to do their jobs—maintain and protect the university's facilities—and I had been trying to do mine—teach the university's students. None of us were in the wrong, so the point is not to find someone to blame. Instead, the point is the power of entrainment, and in this case, long-standing entrainment, perhaps an entrainment pattern generations long. Most of the university's activities, virtually all of its regular class activities, were entrained to the daylight hours, Monday through Friday, and I suspect they had been for generations. Evening classes were nearly nonexistent, so the evening is when cleaning took place. The class phase of activities is during the day; the cleaning phase, during the night. And the MBA program's small expedition into the early night did not fit with that long-established classroom-cleaning cycle, a cycle so strong that it ignored the scheduling of a class in the early evening even though MBA program administrators had scheduled the class at this time by properly following the university's scheduling procedures.

I strongly suspect that what happened to me at my university is not unique, that similar things would have and actually have happened at most universities where the teaching phase of the activity cycle takes place mainly during the daylight hours. And if this has been so for many years, the entire organizational system, not just a few individuals in it, will have become entrained to the day-night pattern, and changes in that pattern are unlikely to be either instantaneous or seamless. This may be useful information for managers who will be managing changes involving the colonization of time, because such changes will disrupt long-established entrainment patterns.

My adventure also illustrates Melbin's observation that as human activity moves into the night, among the changes, especially in organizations, is a regular shift in power. During the night, power and authority often shift to positions lower in the hierarchy and then shift back to higher positions during the day (Melbin 1987, pp. 90-91). This is clearly at least a two-phase oscillation, and one speculates about the possibility of three or more phases if three shifts are involved. Because my course was but the vanguard of expansion into this temporal frontier, meaning the frontier had not yet been colonized by daytime activities, issues of power and authority, such as who had the right to use the room, were contested that had been resolved long ago during the day.

But the night course problems are just a recent example of the day-night cycle's pervasive impact on the rhythms of human life. Many other examples of entrainment have occurred, examples that involve other Zeitgebers. Some of the most profound of these examples involve the invention and diffusion of mechanical clocks as well as the increasing accuracy of mechanical timekeeping. The first of these examples occurred about a century after the mechanical clock was invented in Europe.²

In 1370 a clock was completed that Charles V, king of France, had ordered constructed, and it had been built in a tower of his palace. The clock is sometimes referred to as de Vic's or De Vick's clock (Bolton 1924, plate between pp. 56-57; Crombie 1959, p. 212) in reference to Henri de Vic, the German clockmaker who constructed it. Henri de Vic—the German version of his name was Henrich von Wick, but the French versions are used more often (Usher 1929, p. 159)—had been “caused to be brought from Germany” (Bolton 1924, p. 55) by Charles V for the purpose of constructing this clock. As noted, it is sometimes referred to by its builder's name, but being an especially notable clock, its more usual designations are the Horloge du Palais (e.g., Dohrn-van Rossum 1996, p. 188) and especially, in reference to the structure housing it, the Tour de l'Horloge (Bouvet, Malécot, and Sallé 2000, p. 41): the Tower of the Clock. This clock was the first public clock in Paris (Bouvet, Malécot, and Sallé 2000, p. 41), which is why it may play a central role in a case of pervasive entrainment.

It may play a central role because of a royal decree issued by Charles V in 1370, a decree requiring all clocks in Paris to strike the hours when the clock in the Tour de l'Horloge struck its hours. In the words of Arno Borst, “From 1370 onwards, all Parisian church clocks had to keep in step with its [the clock in the King's palace] somewhat capricious chime” (1993, p. 97); in the words of

David Landes, "Charles V of France decreed in 1370 that all clocks in the city should be regulated on the one he was installing in his palace on the Ile de la Cité" (1983, p. 75). The phrases "to keep in step with" and "be regulated on" both speak to the heart of the matter. The king's decree made the Horloge du Palais the Zeitgeber for the other clocks in Paris, a fourteenth-century version of contemporary phone companies' time information services. And by entraining the other clocks in the city (synchronous entrainment in this case), the sounds of the hour striking in the Tour de l'Horloge would indirectly influence the rhythms of life throughout Paris. It would influence these rhythms by setting the rhythms of the city's clocks, which in turn shaped the patterns of people's lives. (And once again we see a clear example that "In the form of time is to be found the form of living" [Jaques 1982, p. 129].)

Zeitgebers provide stimuli (Aschoff 1979, pp. 6-7), and the striking of the king's clock would certainly qualify as an audio stimulus for the clock keepers of Paris. Indeed, W. Rothwell (1959) has emphasized the importance of the striking clock in general because of its ability to communicate the hour to people "some distance from the clock itself" (pp. 242-43). So using the clock in this way certainly supports its status as a Zeitgeber. It entrained other clocks; the other clocks did not entrain it.

But why would Charles V want all the clocks in 1370s Paris to "keep in step" with his? Different accounts provide different explanations. David Landes (1983, p. 75) speculated that Charles V issued the decree because he wanted to avoid conflicts about the starting and stopping times of work throughout the city, conflicts that would arise if different clocks struck different times. Carlos Cipolla (1978, p. 41) indicated the king acted because he was concerned that not everyone in Paris would be able to hear the sounds of his own clock striking, an explanation that may complement rather than contradict Landes's. And several accounts have described the king's motivation as a desire to break from the church's liturgical practice of keeping time with the canonical hours (Crombie 1959, p. 212-13; Usher 1929, p. 169; Whitrow 1988, p. no).³

The canonical hours were temporal hours (see Chapter 1), so an important component of many of these explanations is the interpretation that actions such as Charles V's represented the beginning of a definitive transition from temporal to equal hours (e.g., Crombie 1959, p. 212; Usher 1929, p. 169; Whitrow 1988, p. no). But part of such an interpretation's appeal may be a tendency to project the twenty-first century's emphasis on equal hours to an era over six

hundred years earlier in which equal hours were just beginning to appear in everyday life. Rothwell provided just such a warning in the conclusion of his analysis of hour reckoning in medieval France: "In interpreting what they [writers from the period being studied] wrote, the modern reader must guard against the danger of transferring to their age the mechanical apparatus and national uniformity of his [her] own times" (1959, p. 250). And there may be even more to the appeal of the temporal-to-even-hour interpretation than this natural tendency to project one's own experiences and meanings to differing contexts and circumstances.

This additional appeal may stem from what Stephen Gould described as Whiggish history, "the idea of history as a tale of progress, permitting us to judge past figures by their role in fostering enlightenment as we now understand it" (1987, p. 4). And if equal hours qualify as "enlightenment as we now understand it," a not implausible impression, then it would be natural to search history for those enlightened pioneers who saw the light and not only began using equal hours but began changing their societies so that others would use them too. So to look for figures at a time when the technology had made the widespread use of equal hours feasible would be natural, and to look for vanguards who took action, like Charles V, equally so. But there is a danger in doing so, for to look this way not only invites transferring the "apparatus" and "uniformity" of one's own times to what one finds in history, but also may make one more likely to accept less critically accounts of "enlightened behavior" that seem to anticipate the road to the present.⁴

This may have happened in the story of Charles V. Part of the story appears correct and unchallenged. He did have Henri de Vic build a clock in a tower of the Royal Palace. What has been challenged is the story about him issuing the decree. Based on a thorough analysis of documents from Charles V's reign and the years shortly thereafter, Gerard Dohrn-van Rossum (1996, pp. 217-20) concluded that Charles V probably never issued the decree to set all of the clocks in Paris marching to the beat of the drum in his palace tower. The evidence is not definitive, it being harder to prove that someone did not do something than that someone did, but at least some serious scholars accept Dohrn-van Rossum's conclusion (e.g., Bartky 2000, p. 230). Much of the case for this conclusion rests on the absence of any records of such a decree from sources written during and after Charles V's reign, such as a biography written about twenty-four years after his death that mentions nothing about such

a decree. As Dohrn-van Rossum stated, "But we find no trace of it [the decree] either in her work or the other biographers of the king" (1996, p. 218). He also questioned whether the king would even have had legal authority over "the church bells of Paris" (p. 219).⁵

So did Charles V really issue the decree in question, a decree ordering the entrainment of all the clocks in Paris to his Zeitgeber in the Tour de l'Horloge? It may be impossible to ever answer this question beyond a reasonable doubt, so Alexander Waugh's use of the word "perhaps" (1999, p. 58) as a preface to the decree story may be the fairest conclusion. But perhaps there is another explanation. Perhaps the clock keepers of Paris, on their own, simply started matching their clocks to the Horloge du Palais. After all, prominent people tend to be trendsetters, and few people are more prominent than kings—especially in the fourteenth century. So clock keepers might have simply started having their clocks keep time in step with the king's as a way to be in fashion—dare I say, to keep up with the times⁶—and this practice may have developed into a tradition over the years; to wit, for the correct time, consult the Horloge du Palais, just as we call the phone company today. Or maybe the clock in the Tour de l'Horloge just had a louder chime or rang more distinctively than the rest, its salience making it easier to detect as a zeitgebend signal. All of this is speculation, of course, but if the clock constructed by Henry de Vic for Charles V did serve as a Parisian Zeitgeber, it may have done so for reasons other than royal fiat.

But *papal* fiats are another matter, and one in particular provides a second example of pervasive entrainment. And this time, no one questions whether that decree was actually issued. Pope Gregory XIII issued it on February 24, 1582, a papal bull putting into effect the recommendations for calendar reform presented to him by a commission he had established for that purpose (Richards 1998, pp. 244-45), thereby culminating centuries of concern with calendar problems, for problems there were.

The Julian calendar, named for Julius Caesar, the famous calendar reformer who instituted it, was used in much of what was then called Christendom, and its problem was that "the average number of days in its year was 365.25, whereas the true length of the tropical year was about 365.24219 mean solar days" (Richards 1998, p. 239).⁷ Although the Julian calendar's accuracy might have been good enough for government work, over the long term its divergence from the true tropical year meant that periodic natural events such as the vernal equinox would stop falling on the same calendar day year after year. And although many

people would never have noticed this discrepancy during their lifetimes because the discrepancy amounted to "an extra day every 128 years" (Whitrow 1988, p. 116), astronomers became aware of it, and they in turn informed others who might do something about it, others such as popes. For this discrepancy was also causing problems with the date of Easter, because the date of Easter depended upon the date of the spring equinox (Duncan 1998, p. 53; Richards 1998, p. 349)—and Easter was moving *seasonally* toward summer (Steel 2000, p. 166). This made the calendar problem especially germane to popes.

With the date of Easter based on a March 21 date for the spring *ecclesiastical* equinox, by the late sixteenth century the discrepancy between the Julian calendar and the tropical year had the spring *astronomical* equinox now "oscillating by almost eighteen hours around midnight on March 10/11" (Steel 2000, p. 166). This is an apt illustration of one of the virtues of a deep-time perspective (discussed in Chapter 5), the ability to spot patterns that are invisible over short time spans. As mentioned, many people would never have noticed the shifting date of an equinox during their lifetimes because it happened only once every 128 years. But over a millennium-and-a-quarter, which by the standards of human life is definitely a deep-time perspective, the pattern of divergence became more and more apparent. The recommendations from Gregory XIII's commission proposed eliminating this divergence and adopting a specific mechanism for minimizing it in subsequent years.

The divergence would be eliminated by canceling ten consecutive days in a single year, the papal bull of February 24, 1582, specifying that October 4, 1582, would be followed by October 15, 1582 (Richards 1998, p. 251), thereby *canceling* October 5–October 14 in 1582. To minimize the problem in the future, fewer leap years would be used such that every fourth year evenly divisible by four would continue to be a leap year (a calendar year with 366 days), except that among these years, the years evenly divisible by one hundred also had to be evenly divisible by four hundred to be leap years (Richards 1998, p. 250). By this rule the year 2000 was a leap year, but 2100 will not be. This change in leap year determination reduced the discrepancy from the one day in 128 years of the Julian calendar to about one day in 3,300 for the reformed calendar (Duncan 1998, pp. 202-3), which is over a twenty-five-fold increase in accuracy.⁸ If any of this sounds familiar, it should, because these reforms produced what is called the Gregorian calendar, the calendar used throughout most of the world today, ironically, for *secular* matters.

This account reveals at least two examples of entrainment. The first is the discrepancy problem and the attempt to achieve synchronous entrainment between the calendar and tropical years, the latter being the *Zeitgeber* entraining the calendar year. Thus the interaction of the sun and the earth plays a *zeitgebend* role once again, just as it does in the daily cycle of light and darkness. And in a manner exactly analogous to Charles V and his new clock over two centuries before (if we accept the legend as true), the second example places Pope Gregory XIII and his new calendar in the role of *Zeitgeber* vis-à-vis the Julian calendars around him. So as Pope Gregory shifted his own calendar to the Gregorian calendar, a *Zeitgeber* shifting its own phase pattern, he provided a very explicit *zeitgebend* signal (the papal bull of February 24, 1582) for others to shift theirs as well.

What happened next followed the general pattern when a *Zeitgeber* shifts its phase pattern (canceling the ten days in 1582). For when a *Zeitgeber* changes its phase pattern by advancing or delaying a phase (e.g., deleting the ten days), it usually takes several periods known as “transients” before the typical phase-angle differences are reestablished between the *Zeitgeber* and the entrained rhythms (Aschoff 1979, p. 7). In this case the typical phase-angle difference to be reestablished would be zero, with calendars in Rome and Paris, for example, experiencing March 21 on the same calendar day. But the general principle indicates that several periods are usually needed to reestablish the typical phase-angle difference (a zero degree difference in this case), and taking Europe as a whole, several transient periods were required indeed.

Although many of the Catholic countries followed the papal bull and implemented the changes described therein (canceling ten days and instituting the new way to determine whether every fourth year qualified as a leap year) during the same year it was issued (e.g., Italy, Portugal, Spain, Poland, France), many of the Protestant countries in Europe took over one hundred periods (years) to reestablish a zero phase angle, England and its colonies in 1752 being one of the last to do so. And countries within the Eastern Orthodox sphere of Christianity took even longer: Romania did not change until 1919, and Greece changed in 1924. Outside the European sphere, Japan changed to the Gregorian calendar in 1873, and China adopted it in 1912 (see Richards 1998, pp. 248-49).

As indicated, today most of the world follows the Gregorian calendar for secular affairs, and it is easy to imagine the problems of coordination that would result from trying to convert back and forth between two or more cal-

endar systems, problems that would result in problems of poor entrainment themselves. For example, E. G. Richards noted, “In 1908 the Imperial Russian Olympic team arrived in London 12 days too late for the games” (1998, p. 247). In 1908 England had been using the *Gregorian* calendar for over a century-and-a-half, but Russia was still using the *Julian* calendar. Problems of coordination indeed.

Not only did Pope Gregory XIII initiate what became a planetwide entrainment effort, thereby illustrating pervasive entrainment, but this effort also illustrates some very important themes. Canceling ten days in a year—countries adopting the Gregorian calendar later had to omit more days because the divergence continued to grow (e.g., the Russian Olympic team was *twelve* days late in 1908)—clearly illustrates human agency in matters of time, and certainly in the case of the calendar that it is a human construction, albeit one intended to reflect important periodic events in nature. And as the Imperial Russian Olympic team learned to its chagrin in 1908, time under the Julian calendar was not quite the same as time under the Gregorian.

The final example of pervasive entrainment returns from the calendar to considerations of the hour and a timekeeper discussed in Chapter 1. That timekeeper was a watch made by Henry Ford, which kept both local time and “railroad time.” Although the phrase fell out of use many decades ago, today the entire world is organized into “railroad time,” perhaps even more thoroughly than it is coordinated by the Gregorian calendar.

This form of time, which would eventually encompass the globe, was implemented in the United States on November 18, 1883. More precisely, on this date Standard Railway Time began going into effect across the country (Bartky 2000, p. 142). And what was Standard Railway Time? It was a system of time zones extending across the country based on a zero hour defined as midnight at the Greenwich meridian in England. The zones progressed in segments of approximately 15 degrees, each one differing from adjacent zones by one hour (see the discussion of longitude in Chapter 4). Within each segment, though, the time was uniform throughout. Thus in the Eastern zone, when it was eight o'clock in Boston, it was also eight o'clock in New York. This uniformity replaced the babel of local times defined by the local position of the sun, a crazy quilt of times that made it difficult to know exactly when trains were supposed to arrive and depart—for passengers, engineers, and ticket agents alike.

Standard Railway Time had no legal standing when its implementation

began on “the day of two noons,” a phrase many commentators applied to it because noon had often come and gone as reckoned by the local times in the eastern segments of each zone before the time in the zone shifted to the new standard-time noon (Bartky 2000, p. 142). Nevertheless, lobbying efforts succeeded in convincing many municipalities to convert to Standard Railway Time, either on November 18 or during the following months. So by April 1884, seventy-eight out of one hundred “principle American cities had adopted the new time standards” (Bartky 2000, p. 146). That several months were required for the seventy-eight cities to adopt the new time reveals the existence of many transient periods required to establish a regular phase-angle difference, just as many transient periods were required to do so after the Gregorian calendar reform began. Interestingly, the system of standard time zones was not codified into law for the entire country until the Standard Time Act of 1918 was passed by the U.S. Congress, with Canada enacting similar legislation in the same year (Stephens 1994, p. 576).

Efforts to extend the principle of Standard Railway Time to a planet-circling set of twenty-four time zones received important support from the International Meridian Conference, which convened in Washington, D.C., on October 1, 1884 (Bartky 2000, pp. 150-51), and was attended by delegates from twenty-five countries (O’Malley 1990, p. 109). This conference dealt with the issue of selecting a meridian to define zero degrees of longitude universally, which would have important implications for cartography as well as for temporal matters. After some wrangling, the conference voted for the Greenwich meridian as the zero longitude meridian, twenty-two to one, with two abstentions (O’Malley 1990, p. 109).⁹

But this group of international representatives had only advisory authority, so their recommendations could be accepted or rejected or ignored by any country at its pleasure. Further, Ian Bartky has suggested that, though important, this conference’s importance in the road to worldwide standard time may have been overemphasized in the historical (Whiggish?) record because he could identify only one country, Japan, that had adopted “a meridian indexed to Greenwich” as a direct result of the conference (2000, p. 152). In the words of Carlene Stephens, “the meeting resulted in the gradual worldwide adoption of the time-zone system based on Greenwich as prime meridian in use today” (1994, p. 575).¹⁰ The key word here is the modifier *gradual*, which also supports Bartky’s interpretation.

How gradually, and in this case how begrudgingly, can be illustrated in France’s adoption of Greenwich as the prime meridian. The French did not adopt the Greenwich meridian until 1911, and even then they camouflaged it, adopting what Michael O’Malley called a “transparent ruse” by defining the prime meridian as “Paris Mean Time, retarded by nine minutes twenty-one seconds” (1990, p. 109). Retarding Paris Mean Time by nine minutes twenty-one seconds places one at the Greenwich meridian! Time is truly socially constructed.

Time Is Money

The examples of Charles V’s clock, Pope Gregory’s calendar reform, and Standard Railway Time all illustrate the importance of Zeitgebers in the way humanity organizes its existence. Indeed, Zeitgebers are so important that people have often been willing to pay money for Zeitgeber information. Almanacs are a good example.

Michael O’Malley wrote of almanacs, “Readers went to the almanac’s time-tables ... to discover the most appropriate time for doing some task” (1990, p. 16). In this sense, almanacs contained and still contain catalogs of Zeitgebers. For example, *The Almanac for Farmers & City Folk 2001* presented a table (p. 104) that specified the days of each month in 2001 that were “considered to be the most favorable for various activities” (p. 103). These activities included the “most favorable” days of each month for dental work, and the “most favorable” days to cut hair, harvest fruit, and conduct business affairs (p. 104).

The advice given by this almanac casts the moon’s phases and its positions in the zodiac in the role of Zeitgebers, phenomena with rhythms that signal the best times to do things such as visit the dentist. So its advice is to entrain synchronously the specified activity with the respective Zeitgeber. And people did and still do buy almanacs to obtain such information.

But people have been willing to pay for more generic Zeitgeber information as well. They have certainly been willing to buy calendars, either for their personal use or to give to current and prospective customers to promote their businesses. But perhaps the most systematic sale of generic Zeitgeber information involves the time of day. In the nineteenth century, at least twenty-two public time services delivered time signals to the public in the United States, most of which were associated with college and university observatories and many of which charged a fee for the service (see Bartky 2000). And when the telephone

companies began their operations, they found a useful source of revenue by providing a number people could call to learn the time of day, a service for which there was so much demand that on the first day (in 1928) that their telephone company offered the time of day for sale, at a price of five cents a call, "New Yorkers ponied up 10,246 nickels" for it (Gleick 1999, pp. 46-47). Phone companies have continued to provide this service to the present day; so when I dial the time number provided by my local phone company, it not only provides the time but also gives its source: "From the United States Atomic Clock." And who would argue with that authority?

But one no longer needs the phone company to keep up with the Atomic Clock. For offered in *The Voyager's Collection* catalog one finds "the award-winning Atomic Watch," which contains "a micro-receiver and antenna circuitry that gets signals right from the U.S. Atomic Clock deep in the Rockies, making the time accurate to one-millionth of a second."¹¹ Beside pictures of two models of the watch, a heading enthusiastically proclaims: "exactly what you need to be RIGHT ON TIME." Zeitgebed to one-millionth of a second! One has to wonder at this conspicuous temporal consumption. Has anyone ever had a problem for being a few *millionths* of a second early or late in *everyday life*? Even a few *thousandths* of a second? But even if not, such excesses do provide another example of Zeitgebers.

Perhaps these examples have created the image of a Zeitgeber as a kind of temporal Big Brother, a dominant rhythm controlling and correcting the behaviors of entrained rhythms. That this happens is certainly true. But Zeitgebers need not always operate continuously for entrained rhythms to persist.

The Persistence of Memory

Joseph McGrath and Janice Kelly conducted a series of studies involving individuals and very small groups (two and four members) (see McGrath and Kelly 1986, pp. 96-103, for an overview and references to the specific studies). The task performed was the solution of five-letter anagrams in a sequence of three differing time intervals. Of direct relevance to the matter of Zeitgebers and their continuous operation, the order of the time periods in which the anagrams were solved was varied as part of the experimental design. Some groups first performed the task in a five-minute interval, whereas others performed the task in either a ten-minute or a twenty-minute interval first. If the five-minute interval came first, it was followed by ten- and twenty-minute intervals; if the

twenty-minute interval came first, it was followed by ten- and five-minute intervals. When the ten-minute interval came first, it was followed by two more ten-minute intervals. The experimental design also varied the groups' workloads (i.e., how many anagrams they were to solve). Among McGrath and Kelly's findings was support for Parkinson's Law: The more anagrams the groups were given during a work period, the more they tended to solve, meaning that the less work a group was given, the less it did during a period, suggesting that work expands and contracts to fit the time available, McGrath and Kelly's proposed expansion of Parkinson's Law (1986, p. 97). (The original statement of Parkinson's Law was, "Work expands so as to fill the time available for its completion" [Parkinson 1957, p. 2].)

The time available, the length of the work period, is also another example of a deadline (the end of the work period), which has already been identified as a general type of Zeitgeber. And McGrath and Kelly found a very important entrainment effect associated with the length of the first work period each group experienced:

People in the conditions that began with the shortest time limit and had longer time limits in successive work periods performed at faster rates, in every condition (that is for every group size, every task load), than those in conditions that began with a long time limit and had shorter and shorter work times for successive trials. The people who had three successive work periods with the same time limit had rates between the other two conditions for the comparable loads and intervals. (McGrath and Kelly 1986, p. 98)

So the length of the initial work period, which can be interpreted as how close the group is to a deadline, affected the pace, the speed at which the group worked, it "established ... a 'temporal entrainment' of the task performance process" (McGrath and Kelly 1986, p. 99). And the speed established during the initial work period tended to persist after the initial Zeitgeber was removed (or altered, depending on how one conceptualizes it). Somehow the group or its individuals collectively learned a pace of work and remembered it in the subsequent work periods. The behavior of the groups that started with the shortest work period (five minutes) is especially informative, because the enlargement of their subsequent work periods could be considered the removal of the Zeitgeber. Nevertheless, the tempo entrainment that occurred during the first period tended to maintain itself even though the specific en-

training Zeitgeber had been removed (or relaxed in a major way). That the tempo entrainment, the pace of work, persisted could be an example of free running, the "natural" frequency exhibited without active entrainment to a Zeitgeber (Aschoff 1979, see pp. 2-6, especially p. 6), which, following Ancona and Chong's (1996) distinction between tempo and pace entrainment, would extend the concept of free running to the "natural" pace of work (i.e., the pace of work without active entrainment to a Zeitgeber).

Now, McGrath and Kelley's groups continued their work for only two work periods after their original entrainment, and the continuation of the same or similar pace could be interpreted as a free-running phenomenon. It could also be interpreted as behavior in one or two transient periods before a new pace would have developed in alignment with the new Zeitgeber (i.e., the new deadlines). So to see whether socially entrained speeds or phase patterns, once established, can demonstrate free-running behavior if the entraining Zeitgeber is removed or modified substantially, a much longer sequence of periods without the original Zeitgeber should be examined. And the trolley schedule in Trenton, New Jersey, provides just such a sequence.

As described at the beginning of this chapter, the guards at Trenton State Prison began their shifts at 6:20 A.M., 2:20 P.M., and 10:20 P.M., and they did so at these times because the trolley stopped near the prison at about these same times. The trolley schedule was a Zeitgeber that entrained the phase pattern of the prison's guard schedule. But this illustration does more than just illustrate phase entrainment; it also illustrates free running. It illustrates free running because in 1967 the guard schedule specified three shifts beginning at 6:20, 2:20, and 10:20, even though the trolleys had stopped running in 1934 (Hirsch 2000, p. 87). The Zeitgeber had been gone for thirty-three years, which means over twelve thousand periods (days) had passed to test whether the entrained rhythm (the guard schedule) would run freely. Clearly the entrained rhythm passed the test, because it had become an institutionalized part of the rhythms of organizational life at the prison. In the words of James Hirsch, in 1967 Trenton State Prison was "a fortress frozen in time" (2000, p. 87), a poetic way to say that the prison had been entrained by a Zeitgeber that had disappeared, but the entrained rhythm had continued as a free-running rhythm.

One suspects that many institutionalized social rhythms are free running, separated by years or decades from the original Zeitgebers that entrained them.

And research conducted by Marcie Tyre and Wanda Orlikowski (1994) may explain why.

Tyre and Orlikowski studied technological adaptation in organizations, which they defined as "adjustments and changes following installation of a new technology in a given setting" (1994, p. 99). Extending their findings to organizational change in general makes them relevant to the issue of institutionalized, hence free-running rhythms. Their key finding was that once a major technological change occurred, organizations would adjust to that change during a relatively short period of time (such periods are "windows of opportunity") and thereafter devote little or no attention to further adjustments. Generalizing more broadly, this suggests that once a change occurs, organizations and individuals adjust to it, and if the results equal or exceed the satisfying threshold, they move on to other matters. Entrainment to a Zeitgeber would be such a change, and once the rest of the system adjusts (schedules for other activities in the case of the prison), the change and adjusting to it pass into the background and concerns shift to other matters. The rhythm becomes institutionalized and will free-run if the Zeitgeber goes away.¹²

Institutionalized rhythms are echoes of Zeitgebers past, and regardless of whether the Zeitgebers are still present, the institutionalized rhythms, as with all institutionalized phenomena, create expectations. Such expectations themselves can become Zeitgebers for new people entering the organization as well as for other organizations dealing with it. And if the expectations are not met, the newcomers and their work tend to be regarded unfavorably, regardless of what they do; but when expectations are met, the work and its producer are evaluated more favorably. An important experiment provides strong evidence for this conclusion.

D. Lynne Persing (1992) conducted an experiment in which she varied the quality of the work produced (a computer program) and the time-use pattern the programmer used to produce the computer program. A variety of time-use patterns are possible, but Persing focused on three: the "early starter," who begins work immediately and intensively, thereby completing the project well before the deadline; the "pacer," who begins work immediately but works on the project about the same amount of time daily and completes it near the deadline; and the "late starter," who does little work on the project initially but whose effort intensifies as the deadline approaches and who just completes the project by the deadline (1992, pp. 3-4). The "late starter" is basically the oppo-

site of the "early starter." Both quality and time-use patterns were experimental manipulations presented in descriptions of the computer programmer given to participants in the study.

When asked to evaluate both the quality of the program and the attributes of the programmer, Persing (1992) found that (1) participants rated the program produced by pacers as better than the program produced by early starters or late starters, with no statistically significant difference between the latter two time-use patterns; and (2) participants rated the programmer described as following the pacer pattern more favorably (e.g., more dependable, more careful, etc.) and as having expended more effort creating the program than either early or late starters, with the latter two patterns again showing no statistically significant differences between each other on these evaluations (Persing 1992, pp. 102-5). These findings from over 150 participants (undergraduate business students) suggest that strong expectations may have developed in the United States for a steady, evenly paced approach to work along with a belief that this pattern of work produces the best quality. For when the quality of the work was controlled experimentally, work produced under a pacing pattern was judged superior to that produced under two uneven patterns, and the producers themselves were evaluated most favorably if they were described in the experiment as having followed the pacer time-use pattern.

This cultural interpretation of Persing's results resonates with a recently developed theory of operations management, the Theory of Swift, Even Flow (Schmenner 2001; Schmenner and Swink 1998). Among other things, this theory postulates that productivity falls as variability increases in either demand on or the steps in the production process. Moreover, Schmenner expressed an expectation that "those elements of human character that support low variability (steadiness) . . . should be valued and encouraged in both the companies and the nations that are high-performing" (2001, p. 89), an expectation that certainly supports a belief in the superiority of the pacer's work pattern. This is so because, as Persing described them, there would be less variability in the pacer's pattern of work than in either the early or the late starter's. Schmenner adds even more support, based on work by Landes (1998), by emphasizing values and attitudes toward time as important cultural factors that support low variability, especially temporal values associated with greater consistency (Schmenner 2001, p. 90). So the Theory of Swift, Even Flow and what appear to be its cultural correlates, combined with the analysis of punctuality in Chapter 4, all lend sup-

port to the proposition, albeit they do not directly demonstrate it, that Persing's results were produced by an American cultural belief in the efficacies of the pacer's pattern of work. However, to what extent such work patterns are genuinely associated with individual productivity remains to be seen.

Before leaving Persing's findings, one important implication of them should be noted. Not only does her research suggest the importance of entraining to expected phase patterns, it also has important implications for performance appraisal. It suggests raters' judgment of the quality of the work being evaluated will be influenced, perhaps inappropriately, by the pattern of time use employees practice in their work.

Such expectations, and their effects on people's responses to whether they are met or not, extend well beyond the organizational domain. In the political sphere, George Washington entrained the United States to an expectation that a president would seek and serve only two terms—thereby becoming not just the father, but the Zeitgeber of his country. It is noteworthy that this institutionalized pattern then free-ran for almost a century-and-a-half after the Zeitgebers' passing, until Franklin Roosevelt ran for a third term in 1940—and then only because of the extraordinary confluence of economic and military emergencies.

And if the theory of writing based on reader expectations (Gopen and Swan 1990; Wilfams 2000) is correct, you are exercising expectations while reading this sentence. This is a structural theory of writing based on two fundamental premises: (1) readers have developed expectations about where in units of discourse (e.g., sentences, paragraphs, etc.) they expect certain types of information to appear, and (2) the wise writer will locate the expected types of information in the expected locations. Using the sentence as an example, structurally there are temporal positions, *phases*, in a sentence (e.g., beginning, middle, and end—note that these are terms that define elements, phases, in temporal sequences), and readers have developed expectations and preferences about the kind of information that should be located in each. An example of a type of information presented in a sentence is important new information. But where is the best location in a sentence for the most important new information? According to this theory based on reader expectations, readers place particular emphasis on the material at the end of a sentence. Thus the best location for the most important new information presented in a sentence is at the end of the sentence. This is what I just did in the previous sentence. The most important new information

I wanted to communicate in that sentence was that the end of a sentence is the best place to put the most important new information. So I put that information at the end of the sentence because doing so emphasizes it.¹³

This theory of writing argues that in general readers find writing clearer, easier to read, and easier to understand if writers place information in units of discourse where readers expect to find it. In entrainment terms this means writers should seek synchronous entrainment, zero phase-angle differences, between reader expectations and where writers put information in sentences and paragraphs. When writers fail to achieve this convergence with readers' expectations, readers rebel and describe the writing as "unclear," "confusing," "hard to follow," and "awkward"; they describe it as bad writing—even though they may not be sure why it is "bad." This is an example of how failing to entrain behavior with expectations produces the feeling that something is wrong, even if it is unclear exactly what is wrong.

In general, a shift away from entrainment with expectations can be seen not just as an indication that something has changed but, if unanticipated, as a warning that something may be wrong. For example, when I send an e-mail message, I click on the send button and move on to other things. My expectation is that even if the person I sent the e-mail message to happened to be online when I sent the message, it should still take at least thirty to sixty seconds before I would hear my computer chime to signal the arrival of a potential reply. Thus my expectation is that at least thirty to sixty seconds are required for a reply *if things are working properly*. But if I hear the chime within one to three seconds, I know one of two things has happened. Either I have just received an e-mail message that has nothing to do with the one I just sent, or I typed the address wrong on the message I sent and it has just been returned as undeliverable. So hearing the chime within a few seconds of sending an e-mail is a warning that something may be wrong. This also includes receiving an automatic out-of-office reply, which often takes a few seconds more to arrive than the message returned as undeliverable. In a sense an out-of-office reply is also an indication that something is wrong, in this case that the person to whom the e-mail was sent won't be around for several days, which is probably a longer period than desired for a reply. In either case, the too-rapid reply differs from my expectation for a good situation.

Similarly, when things take too long, when they take longer than prior experience with them indicates is typical, that too is a sign that something is

wrong. For example, when a researcher submits a manuscript to a journal, hoping to have it reviewed and accepted for publication, worry increases if weeks and then months pass without receiving an acknowledgment that the journal received the manuscript. In the organization sciences, an acknowledgment is expected within two to three weeks, and once a month passes, inquiries at the journal office ensue. This example generalizes to any circumstance when something or someone is late, late in this case meaning *longer than my experience when things turned out well*. Thus parents concerned about their teenage children being out "later than usual" interpret this lack of synchronous entrainment with parental expectation as a sign of potential trouble, that something undesirable is happening. Entrainment with expectations or the lack thereof is a useful control signal, an almost universal rule of thumb about whether things are all right or whether there is reason to worry.

But entrainment with expectations can do more than signal (e.g., Bluedorn 1997); indeed, people often behave proactively, attempting to take control of entrainment, to deliberately align rhythms to achieve their ends by getting important rhythms to entrain with others in a manner they believe will produce more desirable outcomes (e.g., the summer vacation and daylight saving time examples). And such efforts may be some of the most strategic managerial actions that occur anywhere in life.

STRATEGIC CONVERGENCE

The appearance of theories of timing (Albert 1995; Smith and Grimm 1991) suggest a dawning awareness of the importance of aligning rhythms, of entrainment, even if the entrainment frame is not used in these theories. Entrainment's importance stems not just from its own existence but from its relationship with important human outcomes, a point Mary Austin (1970, p. 5) understood early in the twentieth century: "Thus we represent, each one of us, an orchestration of rhythms which, subjectively coordinated, produce the condition known as well-being."¹⁴ Saying that rhythms are orchestrated suggests their entrainment by human agency, a point she makes more explicit in the phrase "subjectively coordinated." So timing is important not only in its own right but even more so for its impact on important outcomes such as human well-being. And from an organization science perspective, a traditionally important outcome has been group and organizational effectiveness.

Converging on Effectiveness

As discussed in Chapters 3 and 5, group and organizational effectiveness is the degree to which a group or organization achieves its goals (see Price 1972, p. 101), and the extent to which an organization is coordinated appropriately promotes its effectiveness (e.g., Lawrence and Lorsch 1967). And entrainment is a major element of coordination. So when Eviatar Zerubavel described "three patterns of temporal coordination" (1979, p. 60) in a hospital, he was also describing three versions of entrainment. One form, temporal symmetry, is synchronous entrainment, as it revealed a consistent phase-angle difference of zero between two shifts, whereas the two other forms revealed consistent nonzero phase-angle differences, but because the phase-angle differences were *consistent*, those forms of temporal coordination represent entrained rhythms as well. Indeed, one of the two forms, "temporal complementarity," involved the maximum possible phase-angle difference, because when one shift was on duty the other shift was off duty. But because this phase-angle difference was constant, this is still entrainment. The other pattern, "staggered coverage," maintained a constant phase-angle difference somewhere in between the other two as the two shift patterns partially overlapped by a constant amount (Zerubavel 1979* pp. 60-61).

It is instructive that Eviatar Zerubavel concluded that "the maintenance of continuous coverage in the hospital would be impossible without *temporal coordination* among physicians and among nurses" (Zerubavel's emphasis; 1979, p. 60). Important parts of this "temporal coordination" were the three forms of coordination Zerubavel identified, which we have seen are examples of entrainment. The reference to "continuous coverage being impossible without temporal coordination" is then clearly an indication that "temporal coordination," entrainment, is necessary for at least minimal levels of organizational functioning and effectiveness. Stephen Barley later employed Zerubavel's concepts to analyze technological change in hospital radiology departments and the importance of "temporal coordination" in the functioning of the departments. He noted, "Temporal symmetry between the work worlds of technologists and radiologists moved toward an even closer *isomorphism* in special procedures" (Barley's emphasis; 1988, p. 153).

Both Zerubavel's and Barley's work emphasized phase entrainment, but the relationship between entrainment and effectiveness is also apparent in studies

of tempo entrainment. For example, Mary Waller (1999) found that flight crews' performance increased the faster they were able to prioritize tasks and distribute activities after a nonroutine event. The effectiveness of flight crews was positively correlated with faster speed for these two key activities (prioritizing tasks and distributing activities), suggesting the environment in which flight crews operate required faster prioritizing and distribution for effective results. And this interpretation is consistent with research on decision-making speed in organizations, which was discussed in Chapters 3 and 4.

To briefly review that research, Kathleen Eisenhardt (1989) found that the speed with which top management teams made decisions was positively correlated with organizational effectiveness. Her sample of organizations was drawn from organizations in dynamic ("high-velocity") environments, and William Judge and Alex Miller (1991) found that this relationship was indeed limited to organizations in rapidly changing environments. These findings too suggest that this environment required faster responses for effective outcomes.

Thus Waller's, Eisenhardt's, and Judge and Miller's studies illustrate a possible positive relationship between tempo entrainment and effectiveness. And in all three studies, the effectiveness is that of work groups (i.e., flight crews) or entire organizations. An even more explicitly temporal example of organization-level entrainment and its consequences for effectiveness occurs in Joseph Ganitsky and Gerhard Watzke's (1990) analysis of joint ventures and the time horizons of the organizations involved. But what of individuals? Does entrainment—phase, tempo, or both—affect individual outcomes? Work by a variety of scholars suggests that it does.

Some scholars, of course, recognize the mutual influence individuals, organizations, and their entrainment have on each other. T. K. Das's (1986, 1987) research revealed that managers' personal time horizons (i.e., future temporal depths) were positively correlated with the length of the time horizons they used when planning for their organizations. Obviously individuals bring personal time horizons to organizations, but as organizational experience becomes a part of an individual's general life experience, that time horizon may be modified by experiences in the organization just as an individual's propensity to use a particular time-horizon depth will influence the depth the individual uses while engaging in organizational work.

Consistent with Das's finding of a positive correlation between individuals' personal time horizons and the planning horizons they employ for their or-

ganizations is an entire theory of individual and organizational time horizons and the importance of their convergence. The theory is stratified systems theory, which was developed by Elliott Jaques (1998a). This theory identifies variance among individuals' time horizons as well as the time horizons required by different positions in organizations, the latter being Jaques's famous time span of discretion, which is "the targeted completion time of the longest task or task sequence in a role" (Jaques 1998a, glossary; see also pp. 37-40).¹⁵ Similarly, the individual has a capability for successfully dealing with certain distances into the future, which Jaques (1998a, p. 24) labeled the individual's *time horizon* and more formally described as "the longest time-span s/he could handle at a given point in their maturation process" (Jaques 1998a, glossary).

Without getting into additional detail (see Jaques 1998a, 1998b), Jaques's stratified systems theory informs the discussion of outcomes from individual-organization entrainment because it puts the position (time span of discretion) and the individual (time horizon) together: "My proposition is that to fill successfully, say, a vacant 7-year time-span . . . role, you will require an individual of a 7-year time-horizon" (Jaques 1998a, p. 24). In entrainment terms, positions should be held by individuals such that there is a zero phase-angle difference between the position's time span of discretion and the individual's time horizon. And the word *should* is used deliberately, because Jaques said "to fill successfully," successfully indicating positive outcomes for both the individual and the organization. Thus *successfully* suggests that the synchronous entrainment prescribed by Jaques will result in better performance, *ceteris paribus*, than other possible combinations, and that good performance by the individual will result in continued employment, pay increases, and so forth for the individual. Further, the good performance will help the organization function better, help it achieve a higher level of goal attainment. Thus stratified systems theory indicates that both individuals and organizations benefit when, in entrainment terms, individuals and their positions are entrained synchronously. But entrainment seems likely to have even more consequences for individuals than suggested in Jaques's theory.

Fitting the Times

Some analyses focus more exclusively than Jaques's on entrainment's effects on individual outcomes, albeit not conceptualized as entrainment. For example, Edgar Schein noted, "Polychronically driven work always has the potential for

frustrating the person who is working monochronically" (1992, p. 114). This statement suggests that individuals respond more positively (i.e., with less frustration) when their free-running behavior along the polychronicity continuum converges with that in their work context (e.g., coworkers, supervisors, the culture in general). And as with Jaques's work, synchronous entrainment is probably the specific form implied.

Although not focused exclusively on individual outcomes, Carol Kaufman, Paul Lane, and Jay Lindquist (1991b) described "time congruity" possibilities between individuals and organizations along several dimensions, including polychronicity. And they also described a wide range of potential outcomes resulting from congruity and incongruity. Noting that polychronic people may have problems in a monochronic environment, they suggested that heavily polychronic people "in a monochronic work group will probably not be near as effective as when they are grouped with others who also are comfortable and capable of combining several tasks at the same time" (Kaufman, Lane, and Lindquist 1991b, p. 99). They would probably not be as comfortable because they would not be entrained well, if at all.

Polychronicity describes a general rhythm for engaging life, and especially if one focuses on the extent to which one moves back and forth between different tasks and events, it is easy to see the polychronicity continuum as describing a wide range of rhythms that characterize people's behavior. Seeing polychronicity as a fundamental rhythm is also consistent with the work of Eliot Chappie (1970, 1971) and Rebecca Warner (1988), which involved a theory of human interaction based on the rhythms of individuals' periods of activity and inactivity, especially language activity, the characteristics of those patterns, and the similarities and differences between individuals' activity rhythms and those of their interaction partners. And just as Schein and Kaufman, Lane, and Lindquist suggested about polychronicity, Chappie and Warner's theoretical work suggested that some activity rhythms can be coordinated, intermeshed, more readily than others, that the ease or possibility of entrainment depends upon characteristics of the rhythms that are to be aligned. Further, there is a strong implication, sometimes made explicit (e.g., Warner 1988, p. 82), that entraining rhythms results in positive outcomes for the individual involved, but a failure or inability to entrain results in less positive outcomes. Schein's reference to "frustrating" and Kaufman, Lane, and Lindquist's to "not be near as effective" are similarly explicit.

Since polychronicity describes rhythmic behavior patterns as well as attitudes about them (see Chapter 3), from an entrainment perspective it makes perfect sense to investigate the degree of congruence between an individual's polychronicity and the level of polychronicity displayed or preferred by the people with whom one interacts, and this point comes through well in a story Edward Hall told when I interviewed him.

Hall described how he had worked with a husband and wife, one of whom was polychronic, the other monochronic, and a French manager (polychronic) whose immediate supervisor was a German (monochronic). In the case of the couple, they "just couldn't get along" (Bluedorn 1998, p. 112), and the situation between the two managers had become "nearly intolerable" (p. 113). Hall reported helping these people by explaining the way they differed in this most basic of behavior patterns and orientations. And once he had explained the differences to them, they could understand what the other was doing and stop misunderstanding it and, most important, stop taling "the other's behavior personally" (pp. 112-13).

Hall's examples illustrate the potential of studying the congruence between an individual's polychronicity and the polychronicity of the people in the individual's workplace, and under the leadership of my colleague Tom Slocombe, this is what he and I did (Slocombe and Bluedorn 1999). In a questionnaire sent to business school graduates, respondents were asked to describe their own levels of preferred polychronicity as well as the level of polychronicity collectively displayed by everyone else in their work units. We anticipated that the closer individuals' personal polychronicity preferences and behaviors were to those of the people in their work units, the more positive the outcomes would be, which is what we found. The closer respondents' polychronicity preferences were to the level of polychronicity behavior they perceived exhibited by other people within their work units, the more committed the respondents were to the organization (i.e., the more they wanted to remain a member, the more effort they were willing to expend for the organization, and the more they accepted the organization's goals), and the more favorably *and* fairly they believed their performance was evaluated. Thus our results were consistent with an entrainment interpretation, one that suggests synchronous entrainment of polychronicity patterns produces the most positive responses.¹⁶

BE CAREFUL WHAT YOU WISH FOR

Perhaps one reason for the intuitive appeal of congruence propositions is the general intuition that they result in positive outcomes for individuals and groups, including organizations. Yet for decades one of organization science's boogeymen has been groupthink (Janis 1972), and what is groupthink but too much congruence? The emphasis on congruence is explicit in Irving Janis's description of the groupthink concept: "a mode of thinking that people engage in when they are deeply involved in a cohesive in-group, when the members' strivings for unanimity override their motivation to realistically appraise alternative courses of action" (1972, p. 9). The phrase "striving for unanimity" is simply another way of saying the group tries to converge on a single decision with every member's public viewpoint and opinion so congruent as to be virtually identical. And temporal factors may be involved in groupthink too. Sally Blount and Gregory Janicik (in press) have suggested that members of a cohesive group will be reluctant to disrupt the group's prevailing pace of work and, further, that this reluctance during group decision making is likely to promote groupthink.

Another example of too much congruence involves a form of entrainment known as resonance. Physical systems are said to resonate when impulses of energy are applied to them at or near the one or more frequencies at which they vibrate naturally, and the amplitude of the system often increases "manyfold as exact synchronism is reached" (Considine and Considine 1989, p. 2430), the "synchronism" suggesting synchronic entrainment as described earlier. But there is danger in "synchronism," in resonance, just as there is potential danger in too much agreement between members of a group. There is danger because the energy applied can resonate too well, the amplitude of the system can increase too much, destroying the system. This is what happens when sound waves shatter a glass, and it is what happened to the Tacoma Narrows Bridge in Washington in 1940. After this bridge was completed it "began to exhibit an unusual natural resonance in which its surface twisted slowly back and forth so that one lane rose as the other fell. During a storm, the wind slowly added energy to this resonance until the bridge ripped itself apart" (Bloomfield 1997, P. 35).

So both groupthink and the resonance examples illustrate the point that neither convergence in general nor its specific temporal manifestation in entrainment are universally "good" from any particular value position. Joanne

Martin (1992) has similarly argued against an overemphasis on cultural homogeneity (i.e., congruence) in the organizational culture domain. But the opposite is also true as revealed by the point that diversity in small groups (Earley and Mosakowski 2000; Watson, Kumar, and Michaelsen 1993) and societies (Bluedorn 2001) does not automatically produce positive outcomes. Sometimes diversity produces what people want, sometimes it does not, and congruence is the same way.

Two thousand years ago Seneca recommended fitting the times (*Tempori aptari decet*; 1834, p. 10), but this advice would be better yet if it were tempered with a qualification to take care about which times one fits oneself to. For not only are all times not the same, they are not all equally important. The sunflower seems to have chosen wisely in picking the time to fit itself to, getting its name "because the flower follows the sun's path across the sky each day" (Perry and Perry 2000, p. 85). As the history of life on this planet shows, one could do much worse than entraining one's activities to the apparent motion of the local star. Indeed, of all the strategies of life, such entrainment appears to be almost ubiquitous—and almost ubiquitously successful. It is the right thing to fit the times—if one picks the times wisely.

The Best of Times and the Worst of Times

O, call back yesterday, bid time return.

—Shakespeare, *Richard II*

A paradox developed at the end of the last century involving some of the worst of organizational times. Research on meetings, which are often some of the worst of times, resulted in some of the best of times for the people who conducted the study. Not only was the research published in a prominent journal, but it led to a modicum of fame—if not fortune—for the research team (which we shall meet shortly). So some of the worst of times were also closely involved with some of the best of times, a paradox. Although paradoxical thinking does not come easily because it requires thinking about contradiction (Quinn and McGrath 1985, pp. 316-17), paradoxical thinking will be necessary in this encounter with the best and worst of times.

For such times, the best and the worst, and what makes them best and worst, are the topic of this chapter. Obviously not every good and bad time can be discussed in a single chapter—or even in a single book—but several prominent good and bad times can provide a basis for understanding what makes times good and bad. To develop this understanding requires us to address issues of connections and meaning; it requires us to develop a better understanding of the relationship between how rapidly time seems to pass and the quality of the experiences associated with different speeds of those passings, the received wisdom about this association requiring significant revision. Such an understand-