

**Entrainment: Cycles and Synergy in Organizational
Behavior**

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Abstract

This paper applies the concept of entrainment from biology to organizational behavior. Entrainment is defined as the adjustment or moderation of one behavior either to synchronize or to be in rhythm with another behavior. Three types of entrainment are identified. Tempo entrainment involves two behaviors having the same pace, such as a top management team working at the speed demanded by the rate of change in its environment. Synchronic entrainment involves two behaviors or processes having similar pace and cycle. An example is the coupling of CEO change with environmental discontinuities. Finally, harmonic entrainment involves the extent of gestalt-like harmonization or meshing of the two behaviors as perceived by outsiders. For example a mentor-mentee relationship involves two people at different points in their career cycle engaged in meshed behaviors. The paper concludes with hypotheses explaining how initial entrainment occurs, why subsequent entrainment is so difficult, how internal and external entrainment compete with one another, and how entrainment is linked to system performance. It is argued that entrainment can explain phenomena not adequately explained by current theory.

INTRODUCTION

Time is arguably the most pervasive aspect of our lives, yet it is also perplexing. On the one hand, we seem to know time so well that we are not aware how it determines when we eat, sleep, work, retire, or even when to have children. On the other hand, we are fascinated by its temporality and transience, and intrigued by the temporal patterns (linear, cyclic, phase, or periodic) that it maps out. Aside from being intimidated by time's unceasing passage, we are also puzzled by its variability in length. Some events, like a boring play or talk, seem to last forever while others, like the changing nature of information technology, rush by so rapidly that we wonder if we will ever catch up.

These multiple conceptions of time are also evidenced by its diverse definitions and usages in a number of different fields. Philosophers have debated the existence of time and questioned if time is real or illusory (MacIver, 1962; Whitrow, 1967). They strive to delineate the past from the future (Polak, 1961), arguing whether to accept the reality of the present (Rubin, 1934). Physicists have raised issues about the variable patterns of time such as the linearity, non-simultaneity, and movement from past to future. In biology, researchers have discovered circaspetum, or seven day cycles, in immune system responses and in blood chemistry changes of both animals and humans, and posit that there might be a biological basis for the 7-day week (Campbell, 1986; Larsen & Kasimatis, 1990). Even in sociology, Marx's alienation theory depicts how the passage of time is needed for the negation of the oppressive thesis to bring about a new order. The seeds of the present state of social reality are sown earlier in time, but the fruits are only reaped now. In anthropology studies are done on the variations of time perception across cultures (Maxwell, 1971), suggesting the symbolic dimension of time. Psychologists have also

studied stages of child (Brazelton & Whetten, 1974) and adult development (Levinson, 1978), arguing for seasonalities in an individual's life cycle.

Time and Organizational Behavior

With few exceptions (c.f. Gersick, 1988, 1989; McGrath & Kelly, 1986), time has not played a significant nor explicit role in organizational behavior research. This is surprising since there are numerous references to time in organizations such as windows of opportunity (Tyre & Orlikowski, 1992), time to market (Clark & Fujimoto, 1987), sequence of activities (Wicker & King, 1988) and organizational life cycles (Cameron & Whetten, 1988). In addition, there also exist specific time concepts of velocity (Eisenhardt, 1990), clocks (Tushman & Keck, 1991), cycles (Homans, 1950), and coordination within time constraints (Thompson, 1967). It is indeed a paradox that while time plays a key role in identifying many organizational phenomena and concepts, it has seldom been isolated, explored, or melded into more general organizational theory.

Part of the problem is the static nature of organizational research. Researchers tend to isolate and stabilize the system they are investigating, paying attention to the effect of a stimulus only on conceptually rather passive systems. This is due to the need for simplification of complex systems in order to understand them, the overt reliance on standardized statistical tests which often assume any variations as noise, and the cross sectional methodologies usually employed. We argue that by incorporating the dynamic nature of systems we would have a better understanding about them. This would help also to explain why the effect of a stimulus at one time may not have the same effect at another time.

The central position of this paper is that time can enrich our theory. Since time can serve as a moderator variable, a mediator variable, an independent or a dependent variable, it is just not possible to anticipate all the possible ways that time could be advanced as being important and relevant to the field of organizational behavior.

In this paper, we will focus only on the concept of entrainment. Huygens, who lived in the 18th century, was the first to notice entrainment (Minorsky, 1962). He observed that when two clocks which separately ran at different speeds were both hung on the same thin wooden board, they became synchronized and kept the same time. Evidently, very feeble interactions due to the ticking being transmitted from one clock to the other through the board were capable of synchronizing the two clocks together.

This concept has been used in a variety of fields (biology, psychology, and linguistics) to explain the alignment of rhythms both within and between systems. Since organizational behavior also explores the behavior of systems this entrainment concept promises to provide some insight into how these systems work. This paper highlights some of the key applications of entrainment in biology, defines entrainment as it will be used in organizational behavior, provides a typology of forms of entrainment with examples from organizational behavior, and finally proposes a set of general hypotheses about the nature and impact of entrainment. We argue that entrainment complements existing organization theory by providing a new theoretical lens through which to interpret existing empirical results. Furthermore, the entrainment concept illustrates the need to examine cycles of behavior over time at multiple levels of analysis rather than continuing to do cross-sectional studies of static behaviors at a particular level of analysis.

The Concept of Entrainment in Biology

The term entrainment is most commonly used in biology, which argues that most, if not all, biological and behavioral processes are rhythmic or cyclical in nature (Oatley & Goodwin, 1971). Entrainment refers to the process whereby an endogenous biological or behavioral rhythm is modified in its phase and periodicity by powerful exogenous influences (external cycles or pacers). The new entrained rhythm will persist even when the external pacers are removed (McGrath & Kelly, 1986). In biology the rhythms studied are usually those found in the human body. The human body contains many processes that move at various temporal orders (microseconds,

minutes, hours, months, years). The synchronization of these processes via their mutual entrainment to each other, and external entrainment to the environment (Aschoff, 1979; McGrath, Kelly, & Machatka, 1984; Pittendrigh, 1972) is necessary to achieve the requisite temporal organization of the human system.

An example is the circadian (meaning about a day) rhythm whereby most bodily cycles are entrained to the external light-dark 24 hour cycle of the earth. When subjects are isolated in sound-proof chambers for several weeks, away from natural light, a number of these bodily cycles, e.g. temperature and urinary cortisol excretion, show the tendency to free-run and resume their "natural" periodicities that are slightly more than twenty-four hours. The internal ordering of these free-running cycles differs from that of a system that is entrained to a twenty-four hour cycle. During entrained conditions maximum temperature occurs during the late afternoon. However, when free-running, the maximum temperature occurs several hours later in relation to the sleep-wake cycle. This implies that the various cycles are no longer entrained and are now coupled to different pacers. These free-running cycles have a highly stable periodicity for any one individual, but vary from individual to individual. It should be reiterated that as McGrath et. al. (1984) point out, each of these processes has its own endogenous cycle that would continue regardless of its synchrony with other processes and the presence of external cycles. Thus, what is modified is not the occurrence of a particular cycle, but rather its periodicity and phase.

Under normal conditions, circadian rhythms are entrained to a 24 hour cycle by means of periodic factors in the environment called zeitgebers (Aschoff, 1979). While for animals the most powerful zeitgeber is the light-dark cycle, for humans these factors are often social as well as physical. Loss of entrainment, which occurs during travel to a different time zone, helps to illustrate some of its properties. First, different physiological and behavioral rhythms re-entrain at different rates. These different rates of adaptation result in various body rhythms being out of phase with one another. Second, performance decrements observed after flights may result from sleep deprivation, but may also be due to the disorder of the circadian system. Third, re-entrainment takes longer following an eastbound flight than a westbound flight due to the natural

tendency of the cycle to be longer than 24 hours. Finally, re-entrainment is enhanced in people who go outdoors compared to those who stay in their hotel rooms, underlining the importance of zeitgebers (Aschoff, 1979; Mackie, 1977).

Entrainment in Organizational Behavior

We need to display some caution in moving from the biological to the social sciences. In drawing analogies between organizational behavior and biology, the level of abstraction needs to be raised so that the biological connotations are fettered out (McKelvey, 1982). That is, we cannot simply make analogies and assume that what holds for some systems will also hold for others. By making the claim for isomorphism, or similarity of form of relationships, we need to show that what exists at one level of analysis also holds at another (Rousseau, 1985). We shall attempt to do that here.

Definition of entrainment

First, in moving to the social sciences, the definition of entrainment will be modified slightly. We define entrainment as the adjustment or moderation of one behavior either to synchronize or to be in cycle or rhythm with another behavior.

Our definition of entrainment differs from that in biology in that the idea of a cause-effect directionality is not imposed. In biology, the notion of a process being captured and modified by an external pacer suggests that the external pacer determines the interaction. We suggest that in the social sciences the concept of entrainment should extend beyond this hint of determinism to incorporate some degree of voluntarism. Entrainment can therefore be conscious, subconscious, or instinctive, and can either result in the system becoming entrained or the system entraining another system. For example, a top management team may instinctively be entrained to the pace of

the external environment, or it may choose to shift its pace to match that of the environment, or it may even try to shift the pace of that environment to better match its own.

We assume that almost all behaviors and processes can be mutually entrained within a system, or externally entrained to some aspect of the external environment. Moreover, systems which are mutually entrained to one another can also be entrained to different pacers. We will further assume that the entrained state is temporary, that is, it is transitory and can be shifted. An entrained system may initially seem to be resistant to a change in cycle, since it may take a transient period for it to entrain to a new pacer.

Types of Entrainment in Organizational Behavior

Thus far we have illustrated the use of entrainment through examples from other fields, defined entrainment, and laid out a set of assumptions about the entrainment process. Now we must show independent evidence of entrainment in organizational behavior, before going on to propose some hypotheses about entrainment to guide future research. The examples to be presented occur at multiple levels of analysis, showing how the entrainment concept can be used to develop multi-level and cross-level theory (Rousseau, 1985).

In cataloguing the examples of entrainment in organizational behavior it became apparent that there are different types of entrainment. We have identified three types: tempo, synchronic, and harmonic. Tempo entrainment occurs when two behaviors or processes operate at the same pace, rate (Lauer, 1981), or speed (Amato, 1983). Synchronic entrainment implies having two behaviors or processes with similar cycles (pace and cyclic phase) or rhythm. A cycle is defined as either "a single complete execution of a periodically repeated phenomenon" or "a periodically repeated sequence of events" while rhythm is defined as "nonrandom variation, especially uniform or regular variation, of any quantity or condition characterizing a process" (American Collegiate Dictionary). Therefore we can see that tempo entrainment concerns the velocity or pace element of a cycle, representing the time frame within which particular behaviors occur while synchronic

entrainment also involves the repeated occurrence of those behaviors. Harmonic entrainment involves the extent of gestalt-like harmonization or meshing of the two behaviors as perceived by observers. The two behaviors need not be at the same pace or phase, but somehow they seem to be in harmony and just go together.

Tempo Entrainment

Tempo entrainment can be illustrated at the individual, group, and organizational level of analysis. At the individual and group level, studies have shown that work is done at the pace that fits the demands present in a given situation. In a series of studies, Kelly and McGrath (1985) showed that individuals and groups who are given five minutes, ten minutes, and twenty minutes respectively to solve anagrams learn to work at decreasing rates of speed. The shorter the time limit, the higher is the rate at which anagrams are solved. McGrath, Kelly, and Machatka (1984) argue "that groups and individuals 'attune' their rates of work to fit the temporal conditions of their work situations..." Kelly (1988) went on to examine the impact of these differential rates of work. She found that while short time limits resulted in higher levels of productivity they also lead to low product quality. In groups high production rates were achieved by cutting out interpersonal interaction and task disagreements which, in turn, hampered quality.

At the organizational level Eisenhardt (1989) illustrates that entrainment to the pace of environmental change is not necessarily automatic, but when it occurs performance is enhanced. In a study of five companies in "high velocity environments" Eisenhardt demonstrates that top management teams that make decisions quickly, matching their pace to the fast-changing environment, are better performers. These teams do not sacrifice thoroughness nor number of alternatives considered, yet they manage to move more quickly in making decisions in response to environmental demands.

Synchronic Entrainment: A Multi-level Example

Synchronic entrainment involves a meshing of cycles, as well as pace. While many different cycles exist, one example is an on-off pattern illustrated in figure 1. In this pattern there is a short period during which the environment is open to influence and evaluation takes place. After this initial period the evaluation is set and there is little an entity can do to change it. To entrain to this open-shut pattern an entity must show quick progress in achieving goals and gaining legitimacy from external constituents. Failure to entrain may result in performance decrements because progress that is made later in time is not perceived by the environment. This pattern can be shown to be functionally equivalent at the individual, group, and organizational level of analysis.

At the individual level, Rosenbaum (1978) presented a tournament model of career development that showed that recognition and mobility early in one's career affects later career advancement. He argues that the initial period in an employees career in a corporation is an important selection period, since by the third year of employment one's eventual career level has been fundamentally determined. If entrainment occurs, an employee shows marked progress early in his career. Those who are late bloomers, or who have poor starting jobs run a much higher risk of slow progress up the corporate ladder in the future. For the latter group, entrainment does not occur in that behaviors are not exhibited in the time frame that the organization allows for making an impression.

In an in-depth study of five consulting teams Ancona (1990) provides evidence for this same pattern in groups. Teams developed distinct patterns of dealing with top management and their clients early in their lifespan. By the time four months were over some patterns or strategies were evaluated by top management to be more successful than others. Based on their strategies, these teams were characterized as successes or failures. Once evaluations were made the organization acted like an echo chamber, with members repeating and magnifying them until they were cast in concrete. Once labeled, teams could only escape from their reputations by breaking up and being reconfigured. Changes in process were not noted in the external environment and data

were interpreted through the bias of prior reputation. Again, for the group to entrain it had to make an impression in the short period of time allocated by top management.

The concept of liability of newness (Stinchcombe, 1965) accounts for new organizations showing higher mortality rates as compared to older organizations. Singh & Lumsden's (1990) study of this phenomenon is an example of early evaluation at the organizational level. Singh argued that the higher mortality rate of young firms is more a result of their inability to gain external legitimacy than of their internal processes of learning, coordination, and socialization. The environment imposes a limited time in which a new organization has to gain legitimacy to exist. Beyond this point, the organization has a much harder time gaining legitimacy and has a higher probability of dying.

Thus, across all three levels of analysis the environment appears to leave a short period of time during which an entity can make an impression. If this is not done, there are major ramifications in the short and long term. Thus, it is not just that individuals, groups, and organizations need to engage in activities such as impression management (Chatman, Bell, & Staw, 1986), external salesmanship (Ashford & Dutton, 1991), and ambassadorial behavior (Ancona & Caldwell, 1991) in addition to their internal activities. This model goes further suggesting that across all entities, synchronic entrainment must occur for them to exhibit appropriate behaviors early, within the period provided by the organization. If these behaviors are left for later there is no entrainment and little chance for redemption.

Synchronic entrainment of the on-off pattern is just one example. At this point, it might seem that entrainment is similar to other related concepts like coordination and integration. We will now present other examples of on-going meshing of cycles that demonstrate even more strongly how entrainment is different. Two such examples include the choice of a labor pool at Disneyland, and the events that occur at the end of a fiscal year in many organizations.

Disneyland is a theme park in California that has been very successful. Attendance at the park follows a predictable annual cycle (Van Maanen & Kunda, 1989). Given that the park appeals in great part to school-age children, attendance at the park peaks during school vacations

including Christmas, Easter, February vacation, and, of course, the summer (see Figure 2). This pattern of attendance poses fluctuating demands on the staffing. Disney has many options to alleviate the problem. They chose to hire college students for many of the jobs. While this choice afforded many advantages including having a pool of young, energetic, good-looking individuals who did not have to be paid very much, it also provided a labor pool whose schedule naturally entrained to the varying staffing demands. College students are available to work at precisely the same time that staffing demands are highest in the park. By choosing a labor pool whose availability entrained to staffing demands Disney was able to save on costs and improve efficiency and morale (Van Maanen & Kunda, 1989).

Perhaps the pattern within organizations that most closely resembles the circadian rhythm within the individual is the fiscal year. While there is no natural light/dark cycle, the fiscal year determines quarters and sets expectations that cannot be ignored. At the end of the fiscal year performance data must be reported, accounts closed, and annual reports written. While the organization sets the date of this event, once it is created the organization must entrain to the demands that arise each year. Many cycles within the organization entrain to this pacer. For example, while there is no inherent reason that planning cycles, performance reviews, sales account closings, or revenue accounting should be yearly events that occur at the same point in time each year, in reality that is the pattern they follow. These internal cycles are set to entrain to the fiscal year. Performance reviews are set so that salaries and bonuses can be calculated and fed into the numbers that must be computed at the end of the fiscal year. Many sales accounts "suddenly" get closed in the fourth quarter in time to be counted in end-of-year bonuses. Division managers with profit and loss responsibilities attempt to pass off costs before the fiscal year ends so that their end of year performance looks better than it otherwise would. The enduring regularity of these behaviors suggests that synchronic entrainment is constantly occurring within organizations at multiple levels and across a multitude of activities.

Thus, in order to understand synchronic entrainment it becomes necessary to study cycles of activity, the periodicity of those cycles, and the differences, or similarities, of those cycles

across levels of analysis. The key unit of analysis is a pattern that repeats over time and that may be highly enmeshed with other activities. Due to this interdependence, entrained activity is very difficult to change. This is positive in some but not all cases. The entrainment of behaviors to the fiscal year provides the organization with a uniform pacer which unifies action within the organization. On the other hand, the "hockey-stick" sales pattern (orders rise sharply at the end of the fourth quarter) may not optimize customer service. Also, entrainment to a yearly cycle may reinforce a short-term orientation that puts the U.S. at a disadvantage vis-a-vis the long-term orientation of the Japanese (Hatvany & Pucik, 1981).

Synchronic Entrainment: A Cross-Level Example

While the on-off pattern, the calendar year, and the fiscal year can be neatly modeled, this is not always the case. The episodic pattern is one where periodic change in the environment is anticipated, but the time of its arrival cannot be foreseen (see Figure 3). Here we provide an example of the impact of matching periods of change at the individual, group, organizational and environmental level that is better understood through the entrainment lens.

An episodic pattern of change is shown in the punctuated equilibrium model of organizations (Tushman & Romanelli, 1985; Gersick, 1991). This model consists of alternating periods of inertia and revolution. During the inertial period the environment remains relatively stable. Then, due to technological, legal, regulatory, or market forces there is a major change in the environment that Tushman and Romanelli call an environmental discontinuity. The rate of discontinuities differs across industries with more stable industries having fewer in a given time period.

Virany, Tushman, and Romanelli (1991) propose a cross-level theory arguing that the performance of a firm is heightened when environmental discontinuities are coupled with major changes in the internal workings of the firm, called reorientations, and CEO and/or top management team replacement. While some CEO's can effect change and do not have to be

replaced, this pattern is less frequent than CEO change, which is often accompanied by major changes in the top management team. This is a cross-level theory in that change at the environmental, organizational, team, and CEO level combine to impact the performance of the firm. While they do not frame it in this way, this model is also an example of entrainment. High performance results from the entrainment, or matching of cycles, across levels of analysis.

We can see that the entrainment concept can provide some new ways of explaining why many firms show performance decrements during discontinuities. First, a discontinuity represents a shift in cycle to which the CEO, the team, and the organization must entrain. However, this entrainment may be difficult since each level may currently be entrained to a different pacer. That is, CEO succession often follows a pattern that is more a function of the CEO's age, experience, accomplishments, and career aspirations (Ancona & Nadler, 1989) than of changes in the environment. The top management team and organization may also follow dynamics of their own and may be more entrained to internal dynamics than external contingencies at a given point in time (Ancona, 1990; D'Aveni, 1991; Gersick, 1988). Thus, the CEO, the top team, and the organization may all be following different pacers; with the consequence that they are not entrained to environmental discontinuities.

A second reason that entrainment may not occur is that the environmental change is not perceived. As Tushman and Romanelli (1985) point out the longer the period of inertia, the less likely there will be change during environmental discontinuities. This may be due to the fact that environmental scanning and external interactions come to follow established patterns and decrease over time (Katz, 1982). As studies show, the ability to entrain to a new cycle is a function of exposure to the zeitgebers, or new pacers, to which the entity must adapt. In the absence of exposure to such zeitgebers the entity does not have the cues necessary to adapt and old patterns remain longer.

A third reason that entrainment to environmental change may not occur is that formerly entrained cycles are inertial. In a study by Kelly (1988) groups retained the rates at which they originally learned to work even when the time they were subsequently given to carry out a task was

increased or decreased. Once a tempo and cycle are set to an external pacer, internal cycles become entrained to that external pacer and to each other, and these become habitual and automatic (Kelly, 1988). Thus, entrainment to a changed environment may take more time than slack conditions in the organization can support.

The entrainment model also provides some possible explanations as to why changing the top team, and the CEO, has such positive outcomes. When teams are first forming they are establishing norms, performance strategies, and external patterns of interaction (Ancona, 1990; Bettenhausen & Murnighan, 1985; Gersick, 1988). At this point they are open to new information and their cycles are getting established. Thus, this team is open to entrainment to a new environmental cycle. Similarly, the CEO at the beginning of his or her term is able to make changes that are later frowned upon. Thus, CEO and top team change provide a mechanism to have the individual and group open to change when it is needed to entrain to the environment.

Thus, the entrainment lens provides an explanation for why inertia may exist and why CEO and team change succeed. The argument is that each entity has a pace and cycle of behavior. These cycles are not easy to change because they become routinized to the pace and cycle of the first external pacer and require the perception of new zeitgebers for cues of change. Furthermore, over time an entity may have become entrained to a different external pacer than the one that is currently presenting a problem. A change in the CEO, top team, and organizational structure are needed because the first entrainment experience appears to be the most powerful (Kelly, 1988), the appropriate external pacer can be chosen, potent zeitgebers are present and the entity is entering the first phase of development when it is open to change and setting new norms.

Harmonic Entrainment: A Multi-Level Example

Harmonic entrainment involves the extent of gestalt-like harmonization or meshing of two behaviors as perceived by observers. The two behaviors need to be in harmony, to go together. For example, while synchronic entrainment involves a matching of period and cycle, harmonic

entrainment may involve two entities at different periods or stages that somehow mesh due to the complementarity of those stages. A multi-level example follows.

Individuals go through a variety of career stages (Graves, Dalton & Thompson, 1980) and life stages (Levinson, 1978). For example a person entering the organization is anxious to learn the ropes, create a good impression, learn about personal strengths and weaknesses, and discover the best career route to take. At the same time such a person is often anxious about getting settled and choosing the right direction, unsure about how to proceed, and extremely self-centered. There is a desire to learn from others and a fear of isolation (Kram, 1985). In contrast, a person who has been in the organization for many years and has climbed the corporate ladder knows the ropes, has a good sense of personal strengths and weaknesses, and has a good overview of the entire firm and how it operates. On the personal end such an individual is more likely to be older and in the generative stage (Erikson, 1963) wanting to pass on individual learning and guide the next generation rather than concentrating solely on self aggrandizement. These two individuals may well find themselves harmonically entrained in a mentee-mentor relationship. They do not share the same cycle, in fact, they are in distinctly different stages of career and personal development. Nonetheless, they appear to go together due to the complementarity or harmony of the different stages they are in.

At the group level, an example of harmonic entrainment is given by the relationships among different groups in an organization. The R&D group is responsible for the design and implementation of new products. Once the new product is ready for production, it is handed over to the production group. The R&D group has in-depth knowledge of the product, having nurtured it from birth to the present stage of its life cycle. The production group has just taken over the product and is eager to learn about it, trying to discover the best way to produce it. The R&D group would be an appropriate source of knowledge for the production group. At the same time, the R&D group would also like to see its new product produced appropriately. There is a meshing of interest between these two groups though they are entrained to different stages of product life

cycle. This symbiotic pairing of the R&D group and the production group exemplifies the complementary nature of harmonic entrainment.

This same harmonic entrainment between an entity at an early stage of development and one at a later stage can be found at the organizational level. In the current wave of strategic alliances firms seek out other firms that have an expertise that they lack. Among these alliances are examples of harmonic entrainment. Such is the case of firms in the entrepreneurial stage who form alliances with firms further along the development cycle (Nadler, Gerstein & Shaw, 1992). Young firms often come into being with an innovative product, service, or idea. These firms are relatively unstructured, small, and always in short supply of cash and credibility. Further down the life cycle are large firms that have become bureaucratic, have very broad product lines, and a great deal more resources. Such firms often have a difficult time retaining their innovative edge across product lines. As such, a pairing of these two firms would be an example of harmonic entrainment. The characteristics of the early and late stages are complementary. The entrepreneurial firm needs money, name recognition, and perhaps a well-established customer base or distribution channel. The established firm needs the innovative product and the new ideas. Although not in the same cycle of development, the two firms seem like they go together, their cycles appear to be in harmony.

Hypotheses

Thus far we have attempted to underscore the relevance of entrainment in better understanding various phenomena in organizational behavior. We have defined entrainment, illustrated some of its properties, and shown how entrainment can be applied. We have also suggested that there can be tempo, synchronic, or harmonic entrainment. We will now present some general hypotheses that can serve as a guide to future research.

Nature of Entrainment

From the three types of entrainment identified above, it is seen that entrainment can occur at all levels and between many forms of systems or entities. We further argue that a system can be subjected to zeitgebers that are either internal or external to it. This makes it possible for entrainment to occur at different levels: at the lower levels within a system or at the system level itself.

We first hypothesize that within a system, a subsystem can entrain, or be entrained by another subsystem. In the biological example at the beginning of the paper it was shown that subsystems within the body needed to be entrained in order to coordinate their differentiated work and to allow for system survival. At the organizational level one can consider three functional groups; R&D, marketing and manufacturing. These organizational subsystems also need to be entrained in order to permit the coordination and communication needed for product development and flows of materials and personnel. While tempo entrainment of these subsystems is unlikely given their highly differentiated pace, synchronic or harmonic entrainment is possible.

We next hypothesize that at the lower levels within a system entrainment can occur between individual subsystems and some aspects of the external environment. The R & D group needs to be at the cutting edge of technological innovation and scientific discovery while the marketing group needs to keep pace with the market and its changing product demands and competitive offerings. Thus, one group within the organization needs to entrain to the pace and rhythm of technological change, the other to market shifts. Tempo entrainment to the external environment has been well documented (Lawrence & Lorsch, 1967) showing that R&D often follows a pace that is slower than other functions. Synchronic and harmonic entrainment to product life cycles and price-performance offerings can also occur (Tushman & Anderson, 1986).

Combining the first two hypotheses it becomes clear that a subsystem can simultaneously be entrained to another subsystem and to some aspect of the external environment. Hence, we argue that subsystems that are entrained to each other can also be entrained to additional zeitgebers,

be it in the external environment or another subsystem. R & D and marketing must be entrained to one another for the organization to function, but each must also stay aligned with subsets of the external environment.

At the system level we hypothesize that entrainment can take place between the system as a whole and some aspect of the external environment. As illustrated earlier, organizations entrain to the pace of the industry that they are in (Eisenhardt, 1989), and to the rhythm of external legitimation (Singh & Lumsden, 1990), and external discontinuities (Tushman & Keck, 1991).

Hence for the organization to function we argue that both internal and external entrainment are necessary unless there is enormous slack that can uncouple the functions' interdependence. Functional groups not only must be entrained with each other for the organization to work, there must also be external entrainment, at both the subsystem and system levels, to ensure adaptation to the environment. Therefore, there can be competition between internal and external entrainment. We propose that the larger the number of subsystems strongly entrained to differentiated external environments and to each other, the more difficult it is for the whole system to achieve external entrainment to a chosen environment.

D'Aveni (1990) found that under normal circumstances successful firms pay attention to both internal and external environments, with more attention to the output environment than to the input environment. When a crisis occurs, however, they pay more attention to the critical aspects of the external environment. We therefore hypothesize that under conditions of threat greater performance can be accrued by entrainment to the proper external environment .

In line with all the entrainment possibilities laid out above, it is therefore not surprising that two similar systems could show markedly different entrainment patterns.

Time of Entrainment

Entrainment is temporal and hence it is an on-going phenomenon in a system. We hypothesize that initial entrainment is likely to be automatic or instinctive, and easier than

subsequent entrainment. Although a system is not a complete tabula rasa when it starts out due to individual schema and previous experience that may influence the starting conditions, this initial period is that which is most open to external stimuli and matching of tempo and cycle (Ancona, 1990; Gersick, 1988; Tushman & Romanelli, 1985). McGrath and Kelly (1986) showed that groups maintained their initial pace even when they were subsequently given more or less time to do the task. Although a change in pace may eventually occur, subsequent entrainment is not as automatic and easy as initial entrainment.

Stinchcombe (1965) also proposed a relationship between the historical time at which an organization is created and the structure that is created within the firm. Some of the features of the social environment at the time of founding imprint the organizational processes that subsequently get institutionalized. The firm also reflects the imprint of the founder (Schein, 1985). This suggests that at the time of founding the organization will establish an endogenous cycle that is entrained to both external conditions and the founder. This entrainment will be the strongest in the firm's history.

Since entrainment is temporal, the entrained state is transitory and can be shifted. Yet as seen from numerous studies (c.f. Eisenhardt, 1989; Tushman & Romanelli, 1985) subsequent entrainment is not automatic, and in fact may be accompanied by abrupt shocks to the system. The situation is analogous to the jet lag condition described earlier. We hypothesize that subsequent entrainment cannot be uniquely determined, but is dependent on the following: (1) the initial condition, (2) the strength of existing entrainment, and (3) the perception of the new zeitgeber.

The nature of the initial condition is critical in determining the facility of subsequent entrainment. In particular the difference between the "periods" of the initial condition and the new zeitgeber is key. Little or no difference between these behaviors would mean less energy and time need to be expended for the system to entrain. A large difference might not lead to entrainment since it would either be impossible for the system to change to the new external cycle, or it may simply take too much time and effort for entrainment to occur and system performance may have deteriorated during that time. In addition, large differences could lead to destructive interference

between existing subsystem entrainment and the new cycle to which it must entrain. Such is the case of re-entrainment following travel across many time zones when subsystems no longer work in concert and behavioral deficits are seen.

Hannan and Freeman (1984) argue that organizations can make changes at the core, but that these changes can not keep pace with environmental change. The result is that selection processes rather than strategic choice determine adaptation to major environmental changes. They also argue that organizational inertia is reinforced by selection processes that favor reliable and accountable organizations. Theirs is basically an entrainment argument showing that initial entrainment is inertial and subsequent entrainment is more difficult when the new periodicity differs significantly from initial conditions.

Subsequent entrainment is also dependent on the strength of the initial coupling between the system and the zeitgeber. The stronger the coupling, the greater the entrainment. This is advantageous for the system so long as the zeitgeber that it entrains to remains the same. If it changes, or if the system must entrain to a new zeitgeber, the system would need more time and effort to get decoupled from this former pacer than if there were a weaker coupling. Even if the initial coupling is weak, an entrained system may initially seem to be resistant to a change in cycle, since it may take a few cycles for it to entrain to the new system.

Finally, subsequent entrainment is much harder to the extent that the zeitgeber must be perceived (McGrath & Kelly, 1986). If it is not perceived, the system's endogenous cycle will not be entrained to the cycle of the new zeitgeber. Again, this is the case of people suffering from jet lag who have a harder time adjusting to the new time zone if they stay in their hotel room away from cues of the new zeitgeber. Subsequent organizational entrainment is also facilitated to the extent that the organization has well developed mechanisms for monitoring the environment, for simulating and reacting to possible environmental changes, and for monitoring other actors in the environment who are also influenced by the new zeitgeber (Dutton & Duncan, 1987; Levitt & March, 1988; Tushman & Romanelli, 1985).

Consequences of entrainment

We hypothesize that under conditions when entrainment, whether tempo, synchronic, or harmonic, occurs with the appropriate environmental pace, rhythm, and cycles, higher performance of the system is usually the outcome. It is assumed that when entrainment occurs energy flows more effortlessly, and relations, performances, and feelings are enhanced (Jones, 1988). If a system, be it individual, group, or organization, is changing more frequently than the entraining zeitgeber, it is expending energy with no reward. This is costly and could hinder the efficient operation of the system. On the other hand, if the system changes less frequently than the entraining zeitgeber, the system might become out of tempo, cycle, or phase, with the zeitgeber.

It is important to note that entrainment to the external environment per se does not result in high performance. Individuals who entrain to the rhythm of organizational life may not perform well if that rhythm is discordant with family and life stages. In Kelly's (1988) study, the groups entrained to the time limits imposed and maintained their initial pace. Groups' performance, however, was based more on whether the initial pace matched the task rather than simply the entrainment to an arbitrarily chosen time constraint. At the organizational level it has been argued that losses in U.S. productivity vis-a-vis the Japanese are due to corporate entrainment to short-term financial targets rather than the long-term view of the Japanese. Thus, entrainment to the external environment only enhances performance if the "appropriate" pacer is chosen, and if entrainment to that pacer can be linked to other necessary entrainment patterns.

Conclusion

The organizational arena is filled with references to time. Practitioners, journalists and theorists alike point to an ever increasing pace of change, to closing windows of opportunity, and to the scarcity of time. Yet those of us in the organizational realms have been slow to incorporate these ideas into theory.

The entrainment lens introduces the concept of time into organizational behavior. It pushes us not just to think of phenomena such as impression management, decision making, and openness to change but also to think about how fast these processes occur, how long they exist before they shift or disappear, and when they are likely to reappear. It pushes us to model cycles, periods, and pace across systems, subsystems and levels of analysis, to examine the main effects and interaction effects of these cycles, systems, and levels, and to relate these effects to performance.

The mutual entrainment of biological subsystems within the human body and to the circadian rhythm illustrates the survival value of such entrainment, its inertia, and the difficulties of re-entrainment. We have argued that individuals, groups, and organizations show some of these properties. It is therefore up to us to design and implement research that models internal and external entrainment, initial and subsequent entrainment, and impediments to re-entrainment. From there we may find better ways to conceptualize and cope with the many meanings and effects of time.

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Figure 1: An On-Off Pattern of Synchronic Entrainment

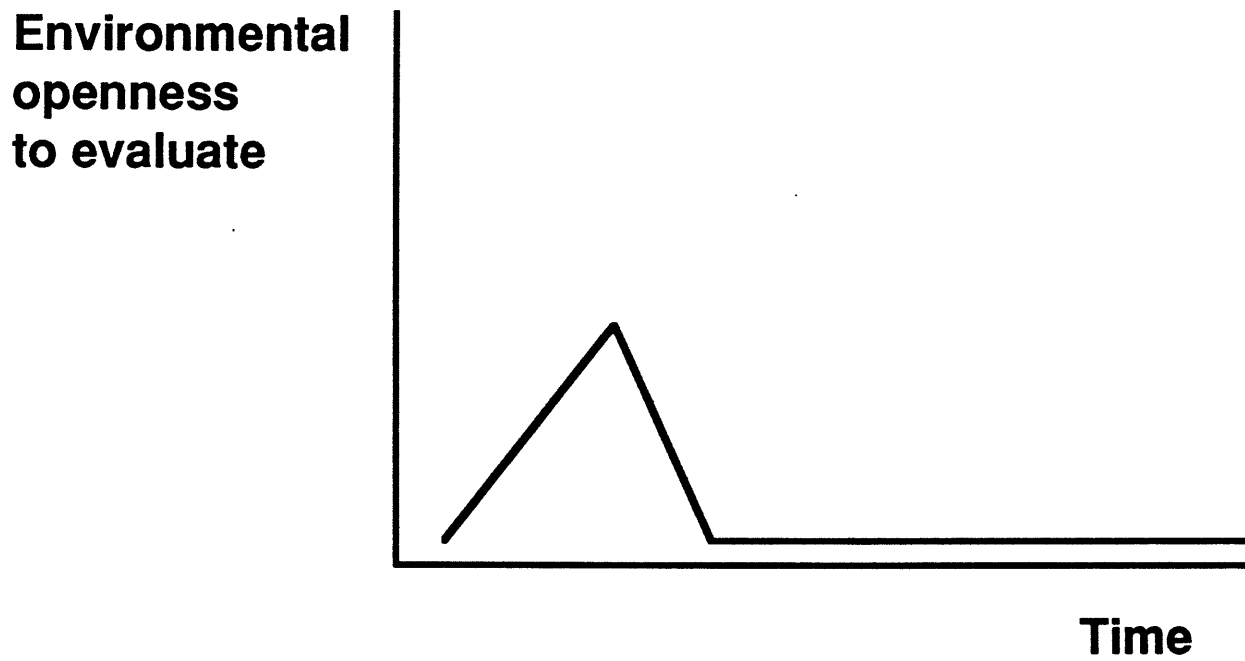
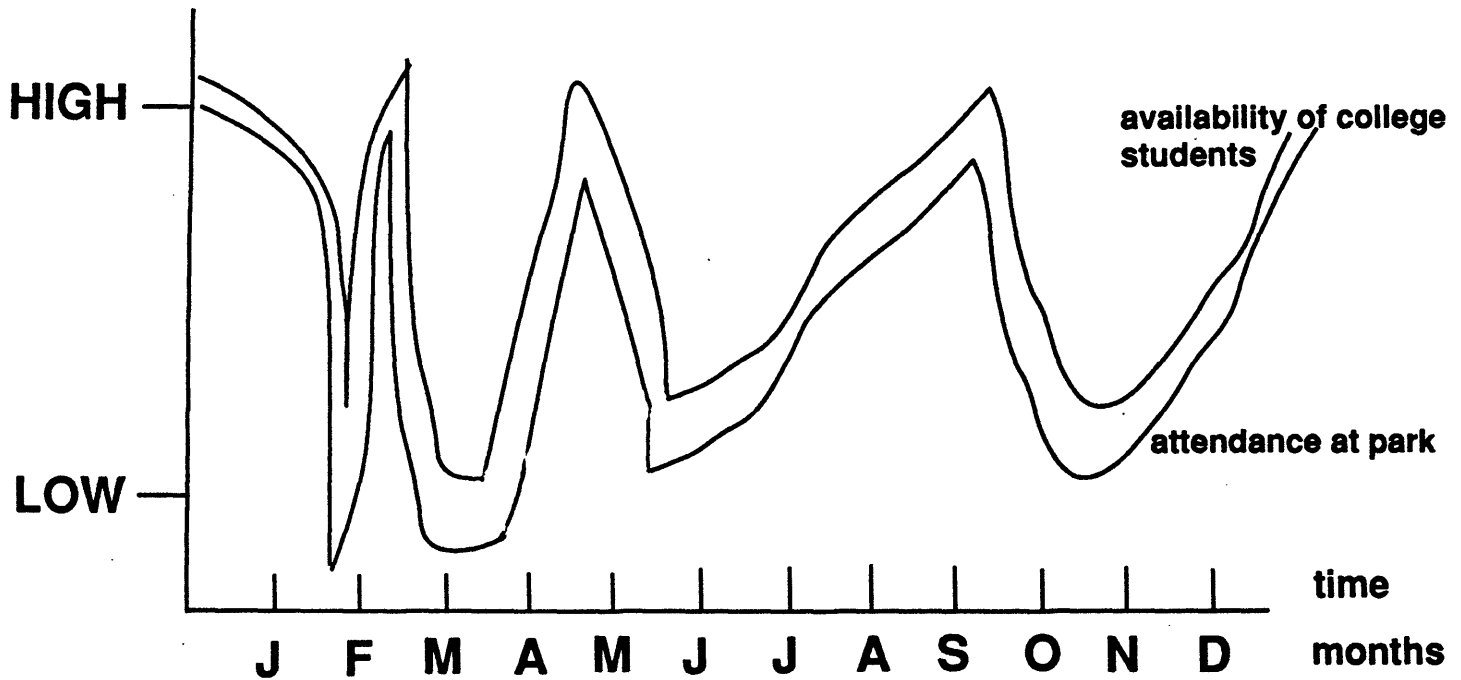


FIGURE 2: Synchronic Entrainment at Disneyland *



***This graph represents a stated pattern; it is not based on actual figures.**

Figure 3: An Episodic Pattern of Synchronic Entrainment

