Theses and Dissertations

8-2012

Time Waits for No One: Using Time as a Lens in Information Systems Research

Christopher M. Conway
University of Arkansas, Fayetteville

Follow this and additional works at: http://scholarworks.uark.edu/etd

 Part of the Management Information Systems Commons, and the Organizational Behavior and Theory Commons

Time Waits for No One: Using Time as a Lens in Information Systems Research

Time Waits for No One: Using Time as a Lens in Information Systems Research

**A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy in Business Administration**

By

**Christopher M. Conway
Rice University
Bachelor of Arts in Computer Science, Mathematical Science, and French, 1983
University of New Mexico
Master of Business Administration, 2011
University of New Mexico
Master of Science in Computer Science, 2011**

**August 2012
University of Arkansas**

Abstract

Despite considerable research interest, IT projects still fail at a higher rate than other projects. Primary causes for these failures are relational, motivational, and scheduling issues on the team. Using the concept of time as a lens, the four essays in this dissertation examine how the ways that individuals and teams structure time can help explain these failures. The essays formulate the concept of temporal dissonance at the individual and team level, and explore how temporal dissonance causes negative consequences for IT workers and IT teams.

Essay one synthesizes temporal dissonance from concepts of temporal congruity and cognitive dissonance. It proposes a model in which an interaction between salience and temporal congruity creates an affective reaction of discomfort, called temporal dissonance. Temporal dissonance provides a partial explanation for the mixed results for time management interventions.

Essay two extends the model and tests it empirically. The essay proposes that IT workers differ in several temporal characteristics from managers, resulting in IT workers feeling more temporal dissonance than managers. This difference results in greater stress and cynicism among IT workers, and results in reduced willingness to meet deadlines.

Essay three extends the theory of temporal dissonance to the team level, using group development processes, shared mental models, and cognitive dissonance as a framework. Conflicting temporal structures salient to the team create tension, called team temporal dissonance. Teams reduce temporal dissonance by engaging in affect and process conflict, which reduces the performance of the team.

Essay four empirically confirms team temporal dissonance in IT project teams. The study finds that the consequences of team temporal dissonance can vary. When internally generated,

temporal dissonance causes the team to engage in process conflict, reducing its performance. Conversely, generated temporal dissonance causes a team to engage in affect conflict as a dissonance reduction measure. The reduction in dissonance improves team performance.

The four essays together triangulate on the concept of temporal dissonance, eliciting its existence from differing starting points. Together, they provide strong evidence of the existence and importance of temporal dissonance.

This dissertation is approved for recommendation
to the Graduate Council.

Dissertation Director:

_____

Dr. Moez Limayem

Dissertation Committee:

_____

Dr. Fred D. Davis

_____

Dr. Pankaj Setia

_____

Dr. Vikas Anand

Dissertation Duplication Release

I hereby authorize the University of Arkansas Libraries to duplicate this

dissertation when needed for research and/or scholarship.

Agreed _____

Christopher M. Conway

Refused _____

Christopher M. Conway

Acknowledgments

I wish to thank the staff of the Graduate School, the graduate staff of the Sam M. Walton College of Business, and the faculty and Ph.D. students of the ISYS department, for help, guidance, and feedback throughout the process of developing this dissertation. I also wish to thank my parents, Dr. Harold E. Conway and Clara Conway, for their help and support.

My committee has been extremely valuable throughout the process of finishing this work, both in their official capacity, and unofficially in meetings, feedback, and hallway chats. Dr. Vikas Anand was extremely helpful with suggestions and leads on developing case study and qualitative methods, as well as pointing to related streams of management literature I had been unaware of. Dr. Pankaj Setia provided insightful and extremely developmental feedback both on written drafts and on presentation, both as part of the formal dissertation process and informally. Dr. Fred Davis provided me with invaluable advice on scoping and extremely interesting leads on temporal aspects, along with his suggestions on theory development. Our long conversations on the brain, flow, and time were as fascinating as they were helpful.

My committee chair, Dr. Moez Limayem, has been tremendously helpful and supportive, both during the development of this dissertation and in a great deal of work that led up to it. The ideas in this dissertation were spawned in meetings with him from the first days of my entry into this program. He was equally essential in focusing on the important aspects of the research. From something as seemingly simple as construct definitions to the most complex hypotheses, his insistence on clarity and conciseness was tremendously useful. I cannot thank Dr. Limayem enough for his guidance, assistance, and advice.

Finally, I especially wish to thank Laine Conway, for all the assistance she has given me. I could never have finished this without her help.

Table of Contents

Introduction

Failure of IT projects continues to be a significant problem in the business world. In 1995, The Standish Group report presents a staggering picture of failure, estimating that over 30% of IT development projects will be canceled, and more than half will cost nearly twice the originally estimated cost (The Standish Group, 1995). The picture today has not improved much in terms of failure percentages, and the cost has continued to go up; failures are currently estimated at 24%, with an annual cost of over $6 trillion (Sessions, 2009). Among the top problems on IT projects are people issues. In a study of 99 failed projects, undermined motivation and poor working relationships among team members affected 37% of those failed projects (Nelson, 2007). Reducing these failures would provide significant returns to business.

Distributed teams are increasingly used to implement these projects. These teams are groups in which the members communicate using one or more information technologies to complete specific organizational tasks (Powell, Piccoli, & Ives, 2004).Team members may be located in many different countries and cultures. These teams offer business considerable potential advantages: access to the greatest expertise on the task at hand, round-the-clock work, rapid response times, and reductions in travel costs (Kankanhalli, Tan, & Wei, 2007). With these benefits, however, come some significant disadvantages. Businesses still struggle to enable effective co-located teams without the complications of virtuality (Useem, 2006).When an element of virtuality is added in, the situation gets worse. Gartner estimates that approximately 41 million employees will work on distributed teams (Useem, 2006). They also predict that "...50% of virtual teams will fail to meet either strategic or operational objectives due to the inability to manage distributed workforce implementation risks" (Biggs, 2000). If business is to

harness the power of distributed teams, it must learn how to make those teams more effective.

At first glance, other than the fact that teams are made from people and thus have a performance impact from their members, there seems to be little to link these two issues-- individual performance and outcomes, and team performance and outcomes. There is, however, another common tie-- a dependence upon time. Time is a common element in research, but rarely as an entity in its own right. Most research incorporating time uses it merely as a duration, as if time were some objective external force, moving forward implacably at a constant rate. This view of time ignores the complex issues associated with it, even at the purely physical level. From a more inclusive standpoint, time has many facets and measures. Many of these measures have their own interesting properties, and can interact with the everyday world in surprising ways (Ancona, Goodman, et al., 2001; Ancona, Okhuysen, et al., 2001; Saunders et al., 2004). In the 2001 articles, Ancona and colleagues call for extensive theorization utilizing time as a construct in its own right, rather than as a simple yardstick. Using time as a lens, this dissertation will show how there is a common cause underlying some individual and team performance issues.

At the individual level, temporal characteristics and the effects of time are a critical part of theory development and testing in organizational behavior (Ancona, Goodman, et al., 2001; Ancona, Okhuysen, et al., 2001; A. C. Bluedorn & Denhardt, 1988; George & Jones, 2000). In the extant literature, tremendous strides have been made in identifying various individual temporal characteristics that affect employees in the workplace. Examples of such characteristics include temporal focus (Shipp et al., 2009), time urgency (Landy et al., 1991) temporal perspective (Zimbardo & Boyd, 1999), circadian rhythms (J. A. Horne, C. G. Brass, et al., 1980a;

Leger et al., 2009), polychronicity (A. C. Bluedorn & Jaussi, 2008), temporal depth (A. Bluedorn, 2002) and pacing style (Gevers, C. G. Rutte, & W. van Eerde, 2006). These individual temporal characteristics have been organized into various theoretical frameworks, including temporal perspective (Ancona, Okhuysen, et al., 2001), timestyles (Cotte et al., 2004), temporal structures (Orlikowski & Yates, 2002), and temporal visions (Saunders et al., 2004), in an attempt to understand and reconcile objective and subjective experiences of time in organizations.

The focus at the organizational level has been upon congruence of temporal models, showing that a lack of congruence leads to negative organizational outcomes including poor performance (A. C. Bluedorn & Denhardt, 1988; Hecht & Allen, 2005; Slocombe & A. C. Bluedorn, 1999). Temporal congruence has also received some attention at the individual level, suggesting that individuals with time structures incongruent with those of their organization suffer stress, leading to health effects and poor performance (Cotte et al., 2004; Carol Kaufman-Scarborough & Jay D. Lindquist, 1999; Slocombe & A. C. Bluedorn, 1999). Few works have looked at these temporal effects at the team level; the few that have tend to focus on one particular aspect of time (e.g. (O'Leary & Cummings, 2007) (Sarker & Sahay, 2004). At the team level, the team's use of time can be critical to its performance (Gersick, 1988, 1989) and disruptions of the team's model of time can cause significant failures in team processes (Labianca et al., 2005).

These findings indicate that congruence or agreement in temporal characteristics can help performance at both the individual and at the team level. However, the complex nature of time suggests that simple congruence does not actually explain these issues; nor, in fact, is it easy to

define "congruence" given the multidimensional aspects of time (Ancona, Okhuysen, et al., 2001). Further, none of this work examines the psychological or social mechanisms by which this congruence operates. Remedies have been suggested, including training, entrainment, and similar time management techniques, yet the results of those techniques when studied have proven to be mixed (Claessens et al., 2007; Macan, 1994). In some circumstances, individual temporal characteristics trigger individual responses and thereby affect outcomes-- but our understanding of when and why this happens is limited. Although prior research has focused on the role of congruence between individual temporal characteristics and the temporal influences and demands of the environment (Cotte et al., 2004; Hecht & Allen, 2005; Carol Felker Kaufman, Paul M. Lane, et al., 1991b; Leger et al., 2009; Slocombe & A. C. Bluedorn, 1999), such research has typically focused on a single temporal characteristic at a time (e.g., preferred and experienced degree of polychronicity, or circadian rhythm and work schedule). What is lacking is a broad theoretical perspective that recognizes that individuals possess a multitude of temporal characteristics which they bring to the workplace, leading to varying levels of temporal congruity in multiple dimensions of temporal characteristics simultaneously. Such a perspective could explain how and when the degree of temporal congruity is likely to affect outcomes in organizational settings.

In order to begin to attain this perspective, we ask the research question: Using time as a lens, what insights can we make into IS worker performance and distributed team performance? In answer to this question, we elicit the construct of temporal dissonance, an affective reaction to a salient lack of temporal congruity. We build a framework based on this construct which provides necessary support to see and understand phenomena in a new way at both the individual

and team levels. We do this by introducing the concept of temporal dissonance. Such a framework is most valuable when it is able to provide a perspective which makes sense out of previously unanswerable questions, resolve paradoxes, provide explanations for previously inexplicable behavior, or provide alternative explanations that shed new light upon a topic. The framework we introduce addresses inconsistent findings on the outcomes of temporal incongruity (Hecht & Allen, 2005) and time management (Claasens et al. 2007; Macan 1994) by arguing that temporal dissonance is the mechanism which translates temporal incongruity into meaningful outcomes in the workplace. This construct provides an explanation for why a lack of temporal congruity only sometimes produces negative outcomes, and time management only sometimes produces positive outcomes, in individuals and teams.

From a practical standpoint, the framework needs to lead to coherent recommendations for practice that would not have been possible with prior theory. The concept of temporal dissonance permits us to understand some of the reasons for mixed results on the efficacy of time management techniques. Using this framework, it is possible to make recommendations about when time management techniques can be effective, and which specific techniques are more likely to be effective.

From a scientific standpoint, this framework allows us to utilize time in new theory development as a multifaceted, multidimensional psychological construct which interacts within the individual and team, producing measurable results and explaining prior paradoxes. The utility of the framework provides a positive answer to the call from Ancona et al. (2001) to make an increasing use of time in management theory.

Because it is a new framework, the theory of temporal dissonance requires considerable

conceptual work, prior to its use in empirical research. For that reason, this dissertation is divided into four essays. Two theory essays provide a new theoretical lens for examining the effects of time in a more nuanced form, by developing a framework showing how to use temporal dissonance in building new theory, first at the individual level, and second at the team level and across levels. Two empirical essays show that that lens is, in fact, useful, by using it to create and empirically test new theory to help explain previous paradoxical results and provide a new perspective on other research. Figure 1 below shows how the essays relate to each other. Each begins with a different starting point-- empirical or theoretical, team or individual, using a perspective germane to the particular starting point-- but all four show that temporal dissonance can be reached from the four different points. This triangulation on the concept of temporal dissonance helps to underscore its usefulness as a construct, and the utility of using a temporal framework to understand IS phenomena.

Essay 1 develops the core definition of temporal dissonance and places it into its nomological network. The research question for Essay 1 is "What mechanism underlies the relationship between temporal incongruity and individual outcomes?" Essay 1 begins with the mystery of mixed results for time management, and uses theories of individual temporal characteristics, temporal congruity, cognitive dissonance, and salience as its starting point. It explores the nature of time, and develops the idea of temporal dissonance at the individual level, specifically that temporal dissonance is an affective reaction to a salient lack of temporal congruity between the temporal structure that the individual constructs from their own characteristics and those temporal structures created by interaction with the surrounding environment. The essay puts forward several propositions about temporal dissonance and its

related constructs.

Essay 1 (OBHDP):
Why doesn't time
management work?
- Individual differences in temporal characteristics
- Cognitive dissonance
- Temporal congruity
- Salience

Argument from theory

Essay 3 (AMR):
Why do teams founder
because of time?
- Shared mental models
- Group development
- Cognitive Dissonance

Argument from theory

Individual | **Team**

Theoretical

Empirical

Temporal
Dissonance

Essay 2 (EJIS):
Why do projects fail?
- IS work requirements
- Correlations between temporal characteristics and required qualities

Quantitative Evidence

Essay 4 (MISQ):
What problems do IS
teams have with time?
- Observation of projects
- Team meetings
- Team member interviews

Grounded Theory

From four different starting points, we find temporal dissonance

Figure 1: How the Four Essays of this Dissertation Relate to Each Other

Essay 2 is an empirical essay, which develops measures for temporal dissonance and related concepts from essay 1, and then uses those as a lens to help explain how IT workers differ from general management and non-IT coworkers. The research questions of this essay are: "Does temporal dissonance help explain project failures?" The essay uses time as a lens for exploring this question. Taking IS work requirements and correlations between temporal characteristics and these requirements, it explores how IT workers differ from their non-IT peers and supervisors in two key temporal characteristics: chronotype and time urgency. These differences create an almost automatic state of temporal dissonance in IT workers that is not found in their peers, which increases stress and cynicism in IT workers. The essay is presented with four objectives: 1) to develop a measure of temporal dissonance; 2) to demonstrate the consequences of temporal dissonance; 3) to show how IT workers and managers differ in systematic ways that result in built-in temporal dissonance in IT workers; and 4) connect our model to willingness of IT workers to meet deadlines. With these results, it is possible to make recommendations on managerial interventions to reduce temporal dissonance in IT workers, reducing the incidence of stress and cynicism found in those workers. Our lens has allowed us to explain why IT workers differ from the other workers around them.

Essay 3 returns to the framework, adding richness to the understanding of temporal dissonance. The research question for the essay is: "What is the mechanism by which temporal congruity affects team performance?" The answers are provided by extending the temporal dissonance concept to the team level. The essay starts from the framework of group development processes, team shared mental models, and group cognitive dissonance to derive the concept of team temporal dissonance. Team temporal dissonance helps explain why mid-point transitions

and entraining meetings can be critical for team performance.

The final essay is another empirical paper. It asks the research question "How does differing deadline pressure affect team performance?" It uses a case study approach based upon two cases of two different IS development teams. One team had a self-imposed deadline of little external importance, while the other had multiple changing externally imposed deadlines of great importance. Yet, the second team performed better, even though it engaged in much more affect conflict than the first time. We show how team temporal dissonance can explain this unexpected result.

This dissertation concludes with a section which shows how the models are developed and relate to each other, finishing with an overall model picture at multiple levels. This section also provides a summary of the implications for both theory and practice, with suggestions for future work.

Essay 1: Adrift in the Sands of Time: A Theory of Temporal Dissonance

Abstract

Time is a rich but inadequately theorized concept. Even work that includes temporal concepts generally has not examined the emotional reaction that people have to temporal differences, nor the mechanisms by which those differences affect individual outcomes. We develop a new construct, *temporal dissonance,* which refers to the psychological discomfort people feel when salient temporal structures lack congruity. We explore the mechanism of its effects, offer explanations for observed phenomena in the business world, and propose avenues for further research.

Introduction

"Early to bed and early to rise/Makes a man healthy, wealthy, and wise."

(Franklin, 1732)

"Early to rise and early to bed/Make a male healthy and wealthy and dead."

(Thurber, 1939)

Time management is a tremendously popular topic for management and self help seminars, books, videos, and other media. A search for "time management" in books on Amazon.com returns 9,886 results as of April 2012; a similar search on YouTube returns "About 18,000 results"; on Google Books, "About 183,000 results"; on Google Blogs, "About 6,810,000 results", and the search on Google without domain restriction returns "About 41,900,000 results". This is a topic which clearly is of great importance; but, equally clearly, no one can agree on how it should best be done. If they could, there would not be literally millions of

opinions on the right way to do it. Indeed, even in the academic realm, we are unsure what exactly time management is, what the right kind of time management is, how it works, and, in fact, even *if* it works (Claessens, Eerde, Rutte, & Roe, 2007). While it seems that time management can fairly reliably create a perceived control of time, this perception does not, in fact, have a reliable relationship with actual work performance (Chang & Nguyen, 2011; Claessens et al., 2007; Macan, 1994). Intuitively, we believe that organizing time more efficiently should improve our performance, but the plethora of ways to organize time, each with its own anecdotal improvement in performance, argues that it does not reliably do so. Whether a time management technique works seems to depend upon the interactions between the techniques themselves, the person using them, and the context in which we find them. The only guide the individual has for finding a working technique is trial and error.

Yet, time is obviously considered a scarce and precious asset. The thousands of books on time management must, in general, earn their publishers money; they continue to be bought by a public eager to make the most of their meager reserves. We are surrounded by clocks, watches, and calendars to help us organize our time. We make time, save time, spend time, waste time, find time, and lose time. Time is so important to us that we have many different ways of looking at it depending on what aspect is currently the most important (Ancona, Okhuysen, & Perlow, 2001; Saunders, 2007; Saunders, Van Slyke, & Vogel, 2004).

If those around us view time differently from ourselves, conflict can result. Consider morning people (larks) and evening people (owls). Everyone knows some strong examples of both larks and owls. The lark, cheerful first thing in the morning, chipper and full of energy, causes great distress to the sleepy and slow-waking owl, who is trying desperately to ingest

enough coffee to start functioning. Later in the day, the owl is finally starting to reach her stride, bright-eyed and bushy-tailed, ready to paint the town red, while the lark is worn out and ready to call it a day. While they may poke good-natured fun at each other, the conflict between these two types of people can become serious; larks may characterize the owls as lazy, slow, or party animals, while owls counter with accusations that the larks are dull, hidebound, and without stamina. This conflict between larks and owls offers a prime example of the differences in individual temporal characteristics that can create serious tensions in the workplace, precipitating negative workplace behaviors and inducing significant costs to businesses in terms of wasted time, lower employee morale, employee turnover, social undermining attempts, and even sabotage.

That there is individual variation in these kinds of temporal characteristics has not escaped academic notice. An obvious conclusion would be that if everyone used time the same way, these conflicts would not occur. This matching of temporal characteristics, called temporal congruity, has received some attention in the past. While temporal congruity is generally considered to be good, with incongruity leading to stress or work-life balance problems (e.g. (Kaufman, Lane, & Lindquist, 1991; Slocombe & Bluedorn, 1999)), prior research offers inconsistent findings regarding the outcomes of temporal congruity (Hecht & Allen, 2005). On reflection, it seems plausible that there is a relationship between temporal congruity and time management, since time management techniques are ways of organizing time. Because they are being consciously implemented, these techniques should change the way that an individual organizes a particular aspect of time. We might conclude that implementing time management techniques could be intended to change the temporal congruity experienced by the person.

However, our understanding of the mechanisms of time management and temporal congruity is limited, making it difficult to assess whether these concepts are connected and how they affect each other. Understanding the mechanism by which temporal congruity is translated into individual outcomes would permit us to better assess how, when, and why temporal congruity matters, and whether it can be related to time management. To begin to develop this understanding, we ask the research question: What mechanism underlies the relationship between temporal incongruity and individual outcomes?

We begin this process with the "Background" section, a literature review providing a grounding in the myriad facets of time and how people structure interactions with those facets. From there, in the "Conceptual Development of Temporal Dissonance", we develop the concept of temporal dissonance. Then, in the "Theory of Temporal Dissonance", we develop a model that explains the process by which differences in temporal characteristics are converted into individual outcomes. We finish with "Discussion", which revisits the question of time management, derives practical and theoretical implications, suggests future work, and provides a final conclusion.

Background

In Table 1, we present a brief summary of the definitions of the constructs that we use. We will explain the definitions in more detail in the sections which follow.

Table 1: Construct Definitions		
Construct	Definition	Example
Temporal Characteristic	A specific attitude or value about a specific type of time. Temporal characteristics are traits.	My body's cortisol level rises slowly early in the morning, therefore my chronotype temporal characteristic is that of an owl.
Temporal Structure	A schema of temporal characteristics used to organize and regulate the interactions the holder of the temporal structure has with the environment.	{"3:15 p.m.," "in the future," "near deadline," "late in the day"}: all part of a structuring of time
Temporal Congruity	The degree of similarity between two or more temporal structures	An owl who works from 11:00 a.m. to 8:00 p.m. has high temporal congruity
Salience of Congruity	The degree to which a lack of congruity becomes important in a specific situation due to the nature of a task and the motivations surrounding the situation	A work requirement that missed deadlines be explained to upper management makes time urgency salient
Temporal Dissonance	An affective reaction of discomfort that may occur when a person has conflicting demands on their use of time	A monochronic person feels irritated by frequent mandated interruptions at work

Time, Temporal Characteristics, And Temporal Structures

Before embarking on a theory of time, it is useful to consider what time is and how we interact with it. Most research has tended to view time as an immutable, objective measure of duration between two states. Even Albert Einstein once suggested, "The only reason for time is so that everything doesn't happen at once." But this view clearly oversimplifies a concept that is richly detailed, with many interlocking, subjective components. The concept of time as objective, constant, and external is actually a relatively recent invention. Sorokin and Merton (Sorokin & Merton, 1937) contend that it was created largely through the industrialization of the Western world, as a tool for turning labor into a commodity. Prior to that point, time was viewed in a much more fluid fashion, gauged as years from an event or seasons or months, which offered

some reference to the natural world. Many temporal constructs that modern people take for granted have no objective basis; the seven-day week is based on Roman market times, whereas other civilizations used weeks ranging from three to ten days. The modern month is largely a random collection of days created by the Romans (Sorokin & Merton, 1937).

The Mutable Concept of Time

Thus there is no one thing that is "time." There are, however, many things with temporal aspects that together create notions of time. We note some of the major kinds of time to underscore the mutability and complexity of the concept.

Physical Time

At the physical level, the current definition of the atomic second is 9,192,631,770 wavelengths of a cesium atom (NIST, 2009). Although this definition appears to offer an objective, concrete measure, it still has limitations. For instance, not many of us are likely to have a cesium fountain atomic clock in our homes. Also, the atomic second does not correspond precisely to astronomical or solar time, so it requires occasional "leap seconds" to correct the relationship, raising the question of which is the "basic" time, solar, sidereal, or atomic. Further, in relativistic reference frames, time is not constant, and its passage may vary (Clark, 1985). Some physicists even argue that time cannot exist as a separately definable entity, distinguishable from the other three dimensions of space. In quantum physics, time often cancels out of equations, such that it is impossible to tell whether events happen forward or backward in time. Even in the largely non-relativistic and non-quantum business world, time remains complicated; virtual teams might include people located in different time zones, with different implementations of clock standardization, such that the question "What time is it?" can

reasonably have many answers, all of which are correct in some way.

Biological Time

A second facet of time is rooted in biological processes, such as circadian rhythms, seasonal variation, and life stages (Horne, Brass, & Pettitt, 1980; Leger et al., 2009). With their biological basis, these types of time are relatively stable for any single individual. Some elements may grow or develop, but the basic clockwork is built into each person's DNA. It is possible to overrule such types of time, but usually only at a cost, as evidenced by the issues related to shift work or jet lag (Folkard, Lombardi, & Spencer, 2006).

Psychological Time

We also note less physical kinds of time. Psychological time is subjective and exists only in a person's mind. Each person uses various types of psychological time to deal with the multiple aspects of time that he or she encounters. Many of the most studied aspects of individual temporal characteristics are types of psychological time. For example, Type A personalities exhibit time urgency characteristics, which help explain their behaviors (Landy, Rastegary, Thayer, & Colvin, 1991; Waller, Conte, Gibson, & Carpenter, 2001). Time perspective refers to a person's propensity to focus on the positive or negative aspects of the future, the present, or the past (Zimbardo & Boyd, 1999). Temporal focus is similar, but drops the affective appraisal, and is concerned strictly with the locus of a person's temporal point of view (Shipp, Edwards, & Lambert, 2009). Chronicity refers to the preference for multitasking; people are monochronic if they prefer doing only one task at a time but polychronic if they tend to multitask (Kaufman-Scarborough & Lindquist, 1999). These are only a few of the most commonly used constructs in psychological models of time; many others can be applied if circumstances warrant

(Ancona, Okhuysen, et al., 2001).

Social Time

Unlike biological and psychological time, which are individual traits, the interaction among multiple individuals' traits can create social time. That is, social time is a shared model of time (Ancona, Okhuysen, et al., 2001; Sorokin, 1964), created by interactions between the temporal requirements of social groups, organizations, or institutions to which a person belongs (Blount & Leroy, 2007). Once adopted, people use social time to structure their interactions with pertinent social groups. Different groups may have different social time characteristics; family social time might be organized around "event time" such as birthdays, anniversaries, or important holidays; work social time likely pertains to "cyclic time" such as quarters, years, or busy seasons; and religious social time focuses on important religious dates (Bluedorn & Denhardt, 1988). Almost any group of humans can generate its own type of time, up to and including complete cultures. Modern U.S. society thus values punctuality and quick results, whereas traditional Asian societies value a longer outlook, and Mediterranean societies tend to be more relaxed about punctuality by emphasizing the ongoing nature of time (Hofstede & Hofstede, 2004).

Economic Time

At a more abstract level, time is a fungible object that can be manipulated or used in various ways. Rather than merely an exogenous variable, successful innovators view time as something that exists and can be used, enacted, and affected. This view even may be a source of their innovation success, in that it appears impossible to untangle time manipulation from innovation (Hellström & Hellström, 2002). During industrial R&D for example, chemical

engineers make, exchange, exploit, invest, expend, extend, and document time with great care (Yli-Kauhaluoma, 2009).

Other Types of Time

This typology is only one of many ways to organize the relevant concepts. Other typologies include event time, cyclic time, dimensions of time, homogeneity of time, continuity of time, and so on (Ancona, Goodman, Lawrence, & Tushman, 2001; Saunders et al., 2004). In these frames, time can repeat, be discontinuous, or proceed in punctuated steps. Applications of subjective clocks appear in disciplines as varied as the Lamport clock in computer science (Lamport, 1978) and the event, set, and symbolic time used by performance theory for drama (Schechner, 2003).

These temporal characteristics and the effects of time are a critical part of theory development and testing in organizational behavior research (Ancona, Goodman, et al., 2001; Ancona, Okhuysen, et al., 2001; Bluedorn & Denhardt, 1988; George & Jones, 2000). Extant literature has made tremendous strides in identifying individual temporal characteristics that affect employees in the workplace, including their temporal focus (Shipp et al., 2009), time urgency (Landy et al., 1991), temporal perspectives (Zimbardo & Boyd, 1999), circadian rhythms (Horne et al., 1980; Leger et al., 2009), polychronicity (Bluedorn & Jaussi, 2008), temporal depth (Bluedorn, 2002), and pacing style (Gevers, Rutte, & van Eerde, 2006). These individual temporal characteristics have been organized into various theoretical frameworks—including temporal perspective (Ancona, Goodman, et al., 2001), timestyles (Cotte, Ratneshwar, & Mick, 2004), temporal structures (Orlikowski & Yates, 2002), and temporal visions (Saunders et al., 2004)—in an attempt to understand and reconcile workers' objective and subjective

experiences of time.

These experiences of time can be tremendously important to theory. For instance, studies of shift workers have found that there is a clear circadian component to incidence of accidents. When people work hours that do not correspond to their natural biological rhythms, they suffer more accidents, injuries and stress (Folkard et al., 2006). The increased risk occurs in a fashion that rules out the possibility that the differences may be due to other confounding explanations such as fatigue or relatively static confounds such as perceived differences in status. Simply working outside the rhythm of your biological clock causes you to be more accident-prone (Folkard et al., 2006).

Even small, seemingly insignificant differences in time can be magnified by circumstances, thereby leading to large differences in performance. In replicating the "punctuated equilibrium" experiment (Gersick, 1989), Labianca and colleagues replicated Gersick's experiment, but manipulated the start times. They started some groups on what they called "prototypical" times, defined as a time on the hour, the quarter-hour, the half-hour, and the three-quarter hour. They started other groups at non-prototypical times, like 7 minutes before the hour or 13 minutes after the hour. Otherwise, the teams were the same; they had the same task, and the same total amount of time to perform the task. In the experiment, the teams that started at prototypical times performed significantly better than teams that started at non-prototypical times. The shift off of the prototypical times seemed to disrupt the natural rhythm of the team. Team members seemed to associate the start time with either the previous or the next prototypical time; because some of the team went forward, and some back, they ended up not agreeing about when it was time to shift into performance mode (Labianca, Moon, & Watt,

2005).

Thus, an understanding of how the individual uses time can be very important to theory development, far beyond the simple idea of time being a yardstick (Street & Ward, 2011). Time is a construct in its own right, one that needs to be considered in more detail to understand how it impacts individual outcomes.

Temporal Characteristics

Each of the kinds of time offers an answer to the question, "what time is it?" according to its own frame of reference. Some types provide simple values, held fairly universally (*e.g.,* physical time, the time on a clock, solar time), whereas others involve complicated values that are held uniquely (e.g., time urgency, time before a deadline). Collectively, we call these perspectives *temporal characteristics*. To situate a person in "time," we need to specify values for each characteristic. Each person also has her own notion of "now" with respect to these characteristics and a personal means of combining, categorizing, and prioritizing the characteristics. Thus "now" might be "3:15 p.m.," "late spring," "well before deadline," "in the present," "time to switch tasks," "late in the day," and "the end of the quarter" simultaneously.

Temporal Congruity

It is generally known that how well an individual "fits" their environment can affect their attitudes toward work, stress, turnover intentions, performance, and other individual outcomes. Within the temporal realm, this has been investigated as temporal congruity. Temporal congruity has typically been studied using single characteristics. Given the complex nature of our relationships with time, however, it is likely that we should consider multiple temporal

characteristics when gauging temporal congruity, in a fashion similar to the multiple characteristics that should be considered for person-environment fit (Jansen & Kristof-Brown, 2006). With temporal characteristics, the groupings are called temporal structures. Temporal structures allow people to control and make sense of their interactions with time (Orlikowski & Yates, 2002). However, this effort becomes complicated, because each person must cope with not just one but multiple temporal structures. In every group—friends, family, work, and so on—temporal structures appear that may need to be taken into consideration. Beyond just the people involved, there may be technologies or abstract groups (such as the workplace as an entity) which have their own temporal demands or affordances which are internalized by the individual into temporal structures representing their environment. When the temporal structures are similar, the person's interaction with time is fairly obvious and straightforward. A manager and a worker who both have time urgency will both be very concerned with deadlines; an interaction between the two concerning a deadline is likely to be simple and straightforward. However, when the two have differing levels of time urgency, the question of how to deal with the deadlines becomes an issue, which introduces the notion of temporal congruity.

In order for temporal structures to interact, they must be internalized. An individual has their own inherent temporal structure representing how they use time naturally. They will also have perceptions of external temporal structures, temporal demands, and temporal affordances, which the individual will organize into a perceived temporal structure for the environment, organization, individual, or whatever is generating the temporal characteristics which are perceived.

Temporal congruity has generally been considered as the degree to which temporal

characteristics match (Kaufman et al., 1991). Generalizing from single characteristics to

temporal structures, we can define temporal congruity as the degree to which an individual's

temporal structure resembles their perceptions of other surrounding temporal structures. At the

individual characteristics level, similarity in chronicity between an employee and an

organization, for example, can improve both individual and organizational outcomes (Kaufman-

Scarborough & Lindquist, 1999). Other studies confirm the value of temporal congruity for other

temporal characteristics, in terms of both the positive value of congruity (Standifer & Bluedorn,

2006) and the negative impact of its absence (Cunha & Cunha, 2004), although the results are

not uniform (Hecht & Allen, 2005). This implies that there should be some unknown element

which interacts with temporal congruity somehow-- either mediates it, moderates its relationship

to the outcomes, or can work counter to it. One obvious possibility, drawn from person-

environment fit, is that this missing part is salience, which should interact with the congruity

construct to produce the outcomes (Jansen & Kristof-Brown, 2006). Indeed, when research

concerning temporal congruity is examined, salience is always implied due to the nature of the

comparisons. For instance, Slocombe and Bluedorn find that congruity in chronicity between a

worker and their workplace improves performance (Slocombe & Bluedorn, 1999). The inherent

nature of the relationship means that if the workplace is perceived to have a chronicity

preference, then that preference will be salient. The workplace provides a preferential value for

chronicity by use of work rules or organizational culture which reinforce the value. The

employee that ignores those rules or cultural norms risks a negative evaluation by the

organization. Almost by definition, organizational temporal structures will be salient.

A simple thought experiment demonstrates, however, that congruity cannot tell the whole

story. Consider, for example, owls (who prefer to rise and stay up late) and larks (who prefer to rise and go to bed early). These *chronotypes* refer to people with differing preferences for structuring their days, likely due to biological differences in their circadian rhythm. Imagine two working groups at the same company with the same manager. Without loss of generality, assume that all the workers are owls and their manager is a lark. The manager—let's call him Larry—tells the first group: "This company is paying you a lot of money. They pay me to make sure that you're worth that money. Because of that, I need to you to work the same hours that I do. I'm a morning person, so I'll expect you to be here, in your seat, and working, from 7:00 a.m. until 4:00 p.m., just like I am." But Larry tells the second group: "This company is paying you a lot of money. They pay me to make sure that you're worth that money. Because of that, I need you to keep a time card. I don't care what time you work, but I need to see eight hours of work time every work day on your time card." The second group clearly will be under considerably less stress. They must work their eight hours, and they suffer the incremental nuisance of keeping a time card; however, they may work at the time they feel is best. They can come in at noon, work until nine, fill out their cards, and not suffer any stress caused by working at times that do not suit them. The first group instead must work against their circadian rhythm. Thus, both groups of workers have exactly the same temporal congruity with respect to chronotype (and other factors vary randomly or can be controlled by the presence of the same manager), yet the first group suffers much more stress, because it must work at hours during which the employees do not feel that they are at their peak performance level.

Thus, temporal congruity alone cannot be the cause of negative effects. Temporal congruity must be made salient to matter at all.

24

Figure 2 shows what a general model of temporal congruity looks like with the addition of salience.
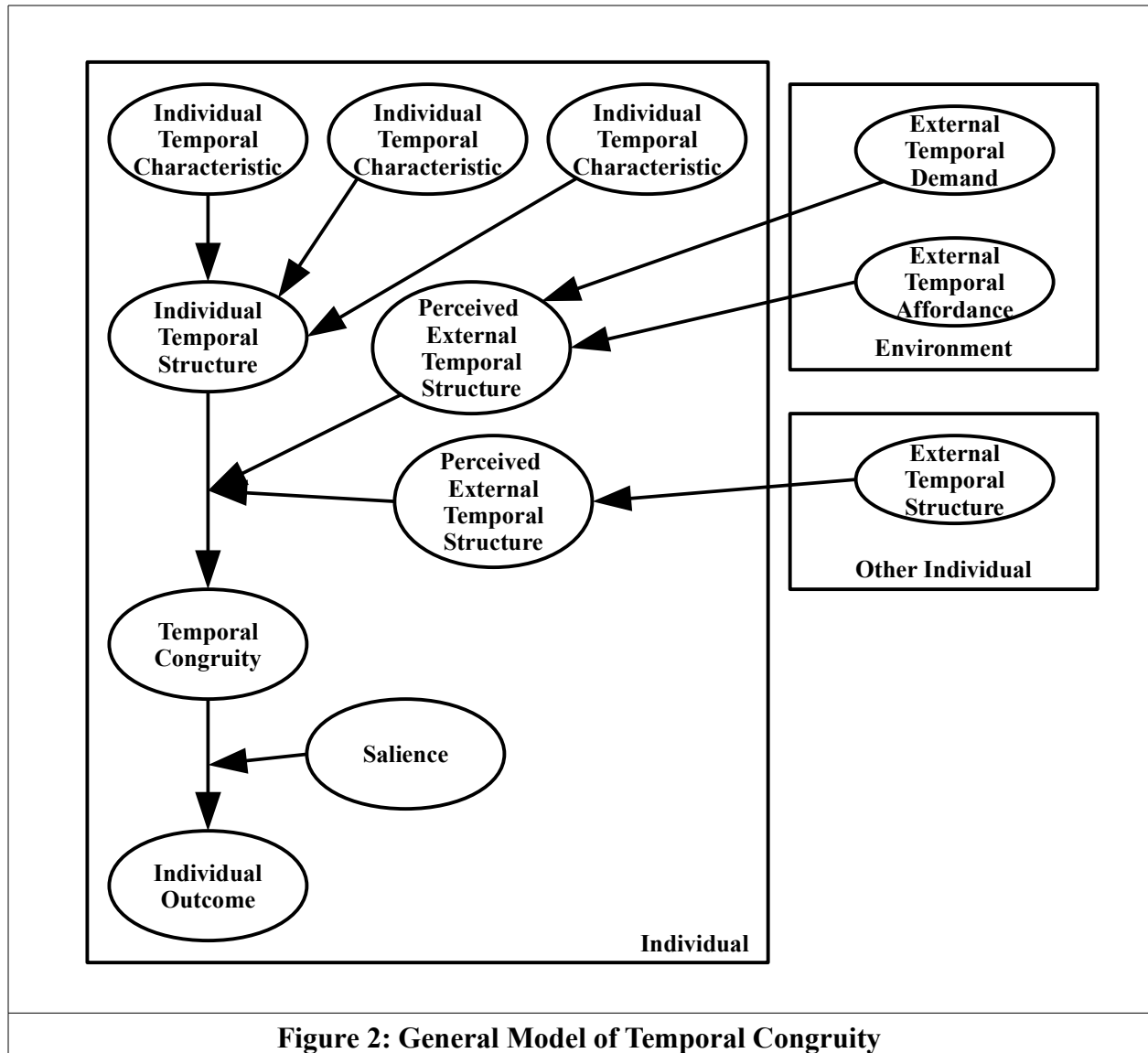
Figure 2: General Model of Temporal Congruity

Conceptual Development of Temporal Dissonance

The introduction of salience to the model makes it more flexible. Since temporal congruity interacts with salience to produce an outcome, this model will explain more complex behavior than a model without salience. However, it still seems incomplete. Recall that temporal

congruity is the degree of similarity between two or more temporal structures. Temporal

structures help make the many temporal characteristics less unwieldy, but, as schema, they

simply represent declarative knowledge of and attitudes towards time. They are not active; they

are not themselves perceptions, feelings, or behavior. Nor is temporal congruity active, because it

only represents a difference between two schema. As such, it is itself a schema. Interacting with

salience produces an important (or unimportant) schema, but it is still inherently a schema

leading directly to an outcome. The outcomes that have been considered in the past consist of

constructs such as health, performance, happiness, or balance. These outcomes are generally

affective, or produced by affect. Affective events theory holds that after perceiving an event,

individuals have an affective reaction, which then can result in changes in affect, behavior, and

cognition. What the model lacks, then, is the affective reaction to the event of salient temporal

incongruity. Temporal congruity is not operative until an event makes it salient; in the presence

of the salience-causing event, temporal congruity fulfills its potential by creating an affective

reaction (Weiss & Cropanzano, 1996). Thus, we need to include the affective reaction as a

mediator between the salience and temporal congruity interaction and the outcome constructs. In

the case of our working groups example, the first group wants to work later but is forced to work

early in the morning. They therefore must internalize Larry's temporal structure by working less

preferable hours, which they will not like, because they will be trying to work when their bodies

are not operating at peak efficiency. However, they are faced with the choice of either defying

their supervisor, or working at a time when they are not at their best. This conflict between two

undesirable options makes them uncomfortable. The second group of owls is aware of the

differences between their chronotype and Larry's, but because they are not forced to adapt to

Larry's chronotype, they feel no discomfort. There will be no negative affective reaction.

Salience and a feeling of discomfort are thus missing links that connect temporal incongruity to outcomes. For our example, we have focused on chronotype, but there is no particular reason chronotype should differ from other temporal characteristics. It even may be that slight differences in any particular characteristic do not cause difficulty alone, whereas when they combine with slight differences in other temporal characteristics, they can rise to the level at which difficulties occur. A pattern of small differences can eventually be perceived as a major lack of congruity, much as small differences in multiple constructs of person-environment fit can result in a large perceived lack of congruity (Jansen & Kristof-Brown, 2006). We therefore must observe the level of congruity between a person's temporal structure (the totality of characteristics) and the temporal structures that person encounters, as well as the salience of those external structures. When the congruity is high, salience should not matter, because the person feels no differences and can easily comply with external temporal structures that match her own. Similarly, when salience is low, the differences do not matter, so no discomfort results. But if the congruity between structures is low and salience is high, we expect the person to experience discomfort.

When an individual has temporal structures that conflict, the individual takes actions to reduce the stress of competing time structures, include emphasizing certain temporal characteristics and downplaying others (Cotte et al., 2004). In organizations, people often force themselves to cope with competing temporal structures when they lack the power to alter them but they will negotiate changes if they can (McGrath, 1991). These actions are highly reminiscent of coping behaviors used to reduce cognitive dissonance, which refers to the

discomfort a person feels when he or she holds two conflicting models of reality internally

(Festinger, 1957). To reduce this discomfort, people often reduce the salience of any beliefs that

appear dissonant with the desired attitude; add consonant beliefs to strengthen their desired

attitude; or attempt to change the dissonant beliefs to remove the dissonance (Aronson, 1969). A

classic example of cognitive dissonance is the phenomenon known as buyer's remorse: A person

has second thoughts about a large purchase and worries that he or she has made the wrong

choice. This tension can be resolved by focusing on the good features of the product purchased

or the less desirable features of the products not purchased.

Furthermore, the general diagram for cognitive dissonance resembles the general diagram

for temporal congruity that we generated, with the exception of the addition of a construct

between the congruity / salience interaction and the negative outcomes. This intermediate

construct is cognitive dissonance itself-- an affective reaction to a salient lack of congruence in a

belief structure and beliefs about the perceived environment. The resemblance between the

general model of cognitive dissonance and the extended model of temporal congruity (shown in

Figure 3), combined with the similarity in actions taken to reduce the consequences of a salient

lack of congruity, further supports the existence of an affective construct similar to cognitive

dissonance. This construct would be the affective reaction to a salient lack of congruity between

individual temporal structures and perceived environmental temporal structures. We have

previously noted that a salient lack of temporal congruity generates an affective reaction, a

feeling of discomfort. Due to its strong similarity to cognitive dissonance, we call this *temporal

dissonance*.

Figure 3: General Models Compared:
Cognitive Dissonance and Extended Temporal Congruity
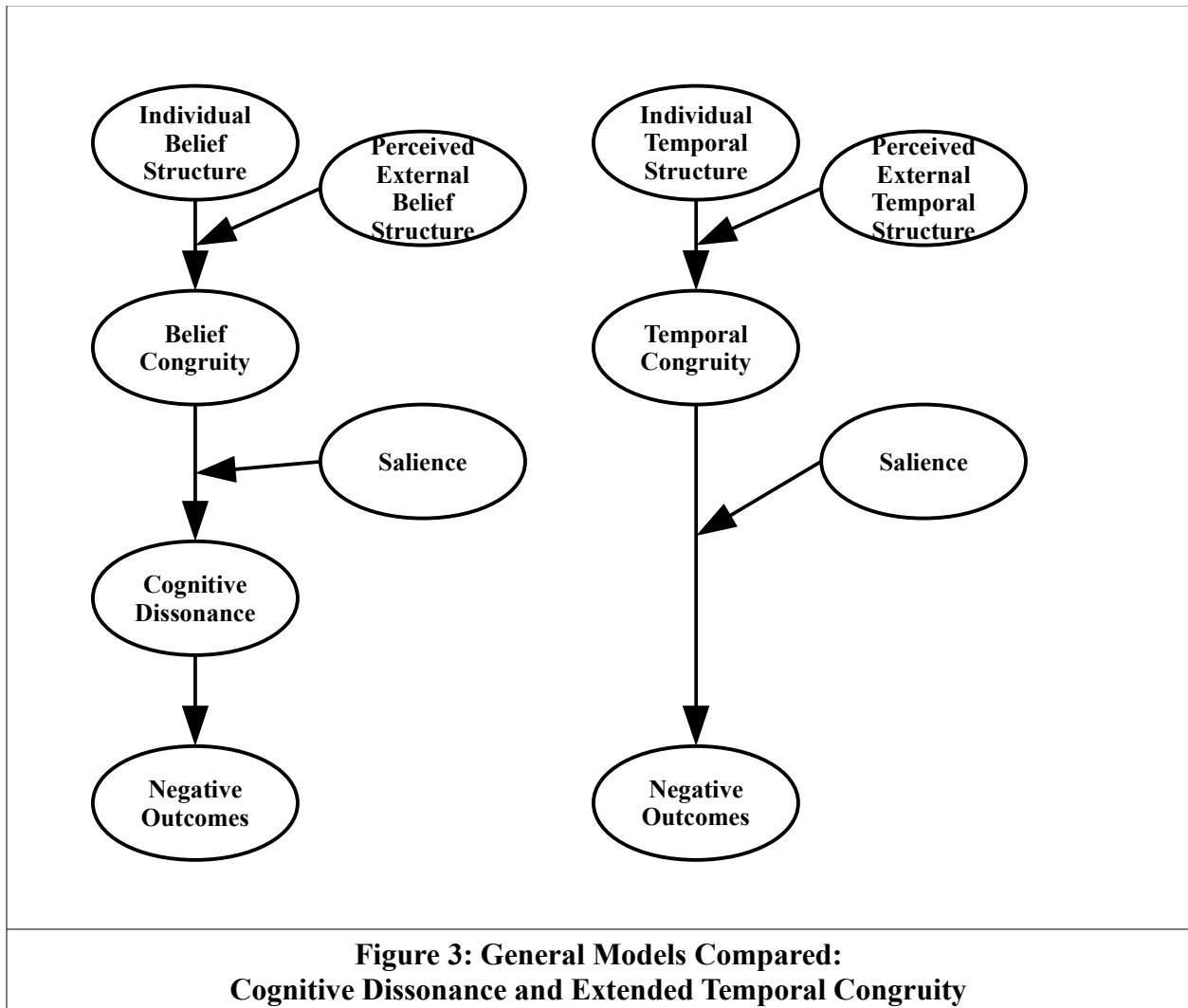
Theory of Temporal Dissonance

With this understanding of some of the issues surrounding the use of time as a construct, and a sufficient vocabulary, we can construct a framework for using temporal dissonance. We begin with a reprise of our definition to provide a structure for our discussion: *Temporal dissonance* is an affective reaction of discomfort that may occur when a person has conflicting demands on their use of time. Because each person has her own trait-based temporal structure, which is always salient to her, any single, salient, perceived external temporal structure can be

sufficient to cause temporal dissonance in the individual, because the person must resolve the

conflict to attain an unambiguous view of time.

As a road map for our discussion, we present a model diagram in Figure 4, which reveals

how temporal dissonance fits into the nomological network. We discuss the components and

relationships next.

Figure 4: Temporal Dissonance Model
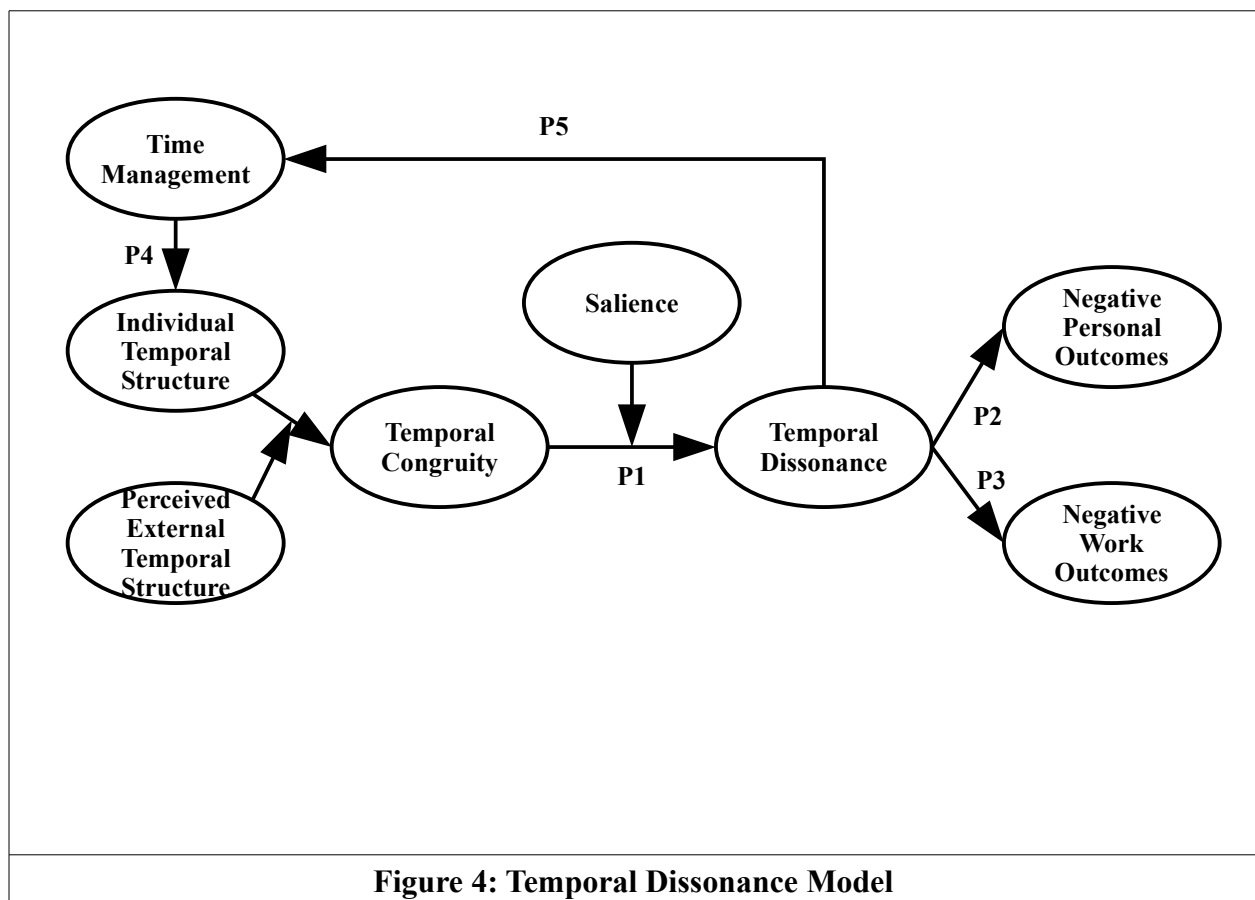
Temporal Structures

The vast number of temporal characteristics makes dealing with time in any complete

fashion difficult. To handle the temporal interaction between ourselves and our environment, we

create internal *temporal structures*. These are schema that allow each person to organize,

consciously and unconsciously, interactions with and uses of time (Orlikowski & Yates, 2002). We generate these schema from our own individual temporal characteristics and environmental and social influences. Multiple temporal structures help people deal with different aspects of the world (Orlikowski & Yates, 2002), such that you may have one temporal structure for organizing interactions with your family but a different one for organizing interactions with your workplace. You also keep internal models of the temporal structures that you interact with, such as your workplace's or a significant other's preferred temporal characteristics. For instance, you might know that your spouse is never ready "on time", or that you should not interrupt them when they are performing a task. These temporal structures may conflict in ways that can cause stress, which is a key source of common concerns about work–life balance (Orlikowski & Yates, 2002) and its potential to harm individual health and performance (Bluedorn & Denhardt, 1988; Slocombe & Bluedorn, 1999).

People both generate and are affected by these temporal structures. Their temporal structures result from interactions between their environment (e.g., culture, organizational ties, institutional memberships, familial ties) and their own personal psychological and physiological characteristics (Blount & Leroy, 2007; Clark, 1985; Saunders et al., 2004). Thus each person must deal with multiple temporal structures: their own and those of the people and groups in their environment.

Temporal Structures Interact to Form Temporal Congruity

The simplest way to think of differences in temporal characteristics is to compare them individually, as has generally been done previously (Bluedorn & Denhardt, 1988; Slocombe & Bluedorn, 1999). Most prior studies address only one temporal characteristic in isolation. If

studies involve two or more characteristics, the situation grows more complicated. Not all temporal characteristics are perfectly independent, so a difference in one characteristic may be partially offset by a countering difference in a related characteristic. Any correlation among characteristics suggests that similarities in one characteristic could partially compensate for differences in another. However, lesser correlation between the characteristics could increase the combined effect of small differences. Both these effects disappear in comparisons of single temporal characteristics.

Consider chronicity and chronotype. These two characteristics are likely orthogonal. There is no reason to believe that the type of chronicity a person has correlates in any way with whether that person is an owl or lark; either can cause a lack of temporal congruity. Recall Larry, our managerial lark, and now assume that he is also monochronic.

Small differences in a particular characteristic may not be sufficient to cause a lack of congruity, as demonstrated by the following example, summarized graphically in Figure 5. One of Larry's fellow project managers, Charles, is an owl, and schedules Larry for working groups in the early afternoon. Even though it his not his preferred working time, Charles is just as monochronic as Larry, so he keeps the meetings focused on one task at a time. Because of this, Larry does not suffer a strong incongruity with his chronotype. Another project manager, Polly, is always working on four projects at once, and Larry finds it difficult to follow Polly's abrupt changes of task in her meetings, so always comes out of them somewhat dazed. However, Polly always schedules her meetings with Larry in the morning, and thus, despite the conflict with Larry's chronicity, it does not cause enough incongruity to be an issue.

Figure 5: Chronotype versus Chronicity Scatter Plot
Larry is a monochronic lark. His temporal congruity with Charles (a monochronic owl) and Polly (a polychronic lark) are of similar magnitude, though Polly is a little further away. The temporal congruity between Larry and Betty (a polychronic owl) is worse than his temporal congruity with either Charles or Polly, since the point Betty occupies in this space is further away.

Larry has a third colleague, however: Betty. Betty is a polychronic owl, who schedules meetings in the early afternoon, like Charles, and wants to work on four projects at once, like Polly. Whenever Larry has to work with Betty, these two small differences together may lead to perceptions of greater incongruity.

To depict this point, we recommend visualizing the two characteristics, chronicity and chronotype, as axes in a scatterplot, as we do in Figure 5. In this example, Larry is monochronic and a lark. He is working on three different projects, managed by Betty, Charles, and Polly, who differ from him in one or more temporal characteristics. Because they are project managers for projects Larry is working on, the difference in temporal congruity between them and Larry is salient. The Euclidean distance between his preferred temporal characteristics and those of Charles or Polly is less than the distance to Betty's. The incongruity with Charles's or to Polly's

characteristics may not be large enough to be significant, but the incongruity with Betty's characteristics may be.

This distinction reveals the need to consider temporal structures when determining temporal congruity (Orlikowski & Yates, 2002). Congruity on a single temporal characteristic may not be sufficient to prevent a lack of congruity overall, nor might the lack of congruity on a single temporal characteristic cause a significant lack of congruity overall. Such a comparison allows for the possibility that differences in individual characteristics are not necessarily additive; in Figure 5, the distance between Larry's preferences and Betty's requirements is the length of the diagonal, which is less than the sums of the differences on the individual characteristics. The picture may be more complicated than a simple Euclidean distance in a two-axis plane. However, considering the temporal characteristics simultaneously in some fashion using temporal structures allows for greater complexity than does comparing characteristics individually.

Temporal structures define how people organize their interactions with time and reflect their temporal characteristics, which are individual traits. The temporal structure itself is a state, such that people interact with time differently, depending on the role they play. A driven Type A executive with high temporal urgency in the workplace thus could become very laid-back and relaxed in a parenting role. Despite a strong tendency for temporal structures to take on trait-based values, this tendency can be overwhelmed by variations due to environmental influences.

Moreover, people never exist in a vacuum. They are continuously subject to influences from individuals and groups around them. Each influence has its own temporal structures. If the structures match the individual's, a condition of temporal congruity exists. If they differ, the level

of temporal congruity declines. In this relatively simple, objective situation, the reaction of any involved party is irrelevant. In our example of the two working groups for example, both groups experienced low temporal congruity with Larry, regardless of the cause of that congruity or their reactions to it. Owls have different temporal structures from larks; the only thing that results directly from that difference is a lack of temporal congruity.

Lack of Temporal Congruity Creates the Potential for Temporal Dissonance

As we have discussed before, an individual who has low temporal congruity with an environmental temporal structure has the possibility of suffering from temporal dissonance. The lower the congruity, the higher the potential for temporal dissonance. However, this is only potential; low congruity, when combined with low salience, will not create temporal dissonance.

Salience of Congruence Creates a Potential for Temporal Dissonance

Similarly, high salience merely creates the potential for temporal dissonance. The simple existence of high salience may or may not lead to temporal dissonance, depending upon the degree of temporal congruity. When the salience is high, either due to constraints placed upon the individual by the environment (e.g., deadlines) or through the nature of the situation being experienced (e.g. a requirement to interface with someone in a different time zone), a lack of congruity can lead to the affective reaction of temporal dissonance. Remember that in the case of Larry's work groups, he makes his chronotype salient to the first group by requiring them to work on his lark schedule, even though they are owls. Because of the lack of congruity, the salience will cause the members of the first team will feel temporal dissonance. With the second group, Larry does not require them to work on his schedule. Because of this, his temporal structure is not salient, and the individual team members do not feel temporal dissonance. If he

had a third team which consisted solely of larks which he also required to meet in the morning, this team would have salience (because of Larry's requirement), but a very high temporal congruity, so they will not feel temporal dissonance.

Salience of Temporal Congruity Interacts with Temporal Congruity to Create Temporal Dissonance

People use temporal structures to organize their temporal characteristics. Each person may have one or more temporal structures related to his or her various roles; each collective with which they interact also has one or more temporal structures. If the particular elements of the temporal structures that are not congruent never are made salient, there will be little affective reaction to the difference and thus little temporal dissonance. If the difference is salient, temporal dissonance should emerge from these incongruities, as an affective reaction.

To understand the interaction, consider two employees, Mary and George. Mary has a low degree of polychronicity; she prefers to do one thing at a time. Company policy requires that employees answer their phones by the fourth ring and answer e-mails within 15 minutes if they are sitting at their desks. These demands causes Mary a lot of distress, because she must constantly interrupt her work to multitask and cope with the demand. Larry knows that Mary works very independently, and her coworkers do not depend on her presence to get their work done. Therefore, Larry agrees to Mary's request that she be allowed to do most of her work in the company library, where she will not have to answer the phone or e-mails. Thus, despite the lack of congruity between Mary's and the employer's temporal structure, Larry's action decreases the salience of that difference, and Mary does not suffer from temporal dissonance.

George has low time urgency and thus pays minimal attention to deadlines. The company

requires that the reports he generates must be done by 1:00 p.m. every day. Larry has reprimanded George for missing those deadlines, and told him that if he misses them any more, he will be fired. There is a lack of congruity between George's temporal structure and that of his workplace, made very salient by Larry's threat, so George feels strong temporal dissonance.

> *Proposition 1: Temporal congruity and its salience interact to determine temporal dissonance. Low congruity and high salience leads to high temporal dissonance. When either congruity is high or salience is low, temporal dissonance is lower.*

Increased Temporal Dissonance Leads to Negative Personal and Work Outcomes

Suffering from temporal dissonance often creates negative consequences for individual employees and their work performance. Considering unique temporal characteristics, prior research shows that differences between employee and workplace characteristics increase employee stress, because they subvert the employee's natural way of working (Saunders et al., 2004). If employees can work according to their natural rhythm, they do not experience difficulties, but if they are required to work in another rhythm, they experience stress and its negative consequences. These outcomes emerge clearly in studies of shift work: Employees who work second or third shifts suffer more stress, poorer health, higher accident rates, and lower productivity (Folkard et al., 2006).

Temporal dissonance helps explain why. The lack of temporal congruity becomes salient, so workers feel psychologically uncomfortable, which increases their stress as they attempt to resolve the conflicting temporal structures. If Larry insists that Mary (who is monochronic) sit at her desk one day and answer calls and e-mails while she works, because an important deadline is approaching, she must try to multitask. She may find it difficult to concentrate on her task at

hand, because she constantly must check whether she has received messages and attend to the sounds around her. She might ignore Larry's request and continue to work in the library, but then she risks his displeasure and a possible reprimand. Either option has drawbacks for Mary, and the need to make the choice causes further stress. Such stress can be physical (distraction due to sounds and the need to check e-mail), psychological (the choice to sit in the library), or both (she works at her desk but gets so engrossed in her task that she misses incoming e-mails). Either choice produces physiological effects of stress; that is, her higher levels of temporal dissonance lead to higher levels of stress. Stress in turn causes reduced motivation, greater neuroticism and turnover intentions, and negative impacts on workers' health.

Mary offers only one example; other individual-level consequences depend on the method the employee uses to reduce temporal dissonance. Because temporal dissonance depends on both a lack of congruity and the salience of that lack of congruity, we recognize that it is possible to reduce temporal dissonance by either minimizing salience or increasing congruity. Salience reduction might occur through ignoring or discounting cues in the external environment; perhaps Mary decides that Larry's request is really not very important. She might imagine his boss was leaning on him, and Larry needed to appear to do something; Mary still believes that Larry cares little about where she works, so she decreases the salience of his request.

However, if Mary continues to suffer temporal dissonance, she might be subject to increased stress, she may begin to have negative reactions to Larry or her employer, she might perform more poorly, and might suffer from disillusionment, cynicism, or job burnout. She may become upset at Larry for seemingly shifting the blame to her, such that she creates an affective

response that counters the perceived salience of his request. The request may seem like a psychological contract violation, in that Larry had promised she would be able to work as she preferred. Or she might try to contact Larry's boss and appeal the request. If successful, this last strategy could modify the temporal structure with which she interacts and bring it into closer congruity with her own. However, such a move also could affect her image in the organization, and, depending on the boss's reaction, influence her feelings of cohesion with the company. If she persists in believing there is no rational basis for the requirement that she sit at her desk, disillusionment with the company likely results; if the problem persists, she also may begin to exhibit symptoms of job burnout. Each of these scenarios has consequences for Mary personally (i.e., her happiness, stress, and job satisfaction) and for her work performance (i.e., cohesion, burnout, and performance decrements caused by working in a non-preferred temporality). These examples represent only some of the possible negative outcomes for both the individual and his or her work performance; further research should consider other specific outcomes as well.

> *Proposition 2: Increased temporal dissonance increases negative personal outcomes for the individual.*
>
> *Proposition 3: Increased temporal dissonance increases negative work outcomes for the individual.*

Time Management Alters Temporal Structures

Time management systems are prescriptive temporal structures. While the core temporal characteristics which are used to populate temporal structures are traits, the schema of the temporal structure is itself a state-- it is loaded with default trait values, but those values can be overridden by the current situation if necessary. If practiced long enough, the training can affect

the traits themselves, but normally the effect will be seen purely in the state of the current temporal structure. Because the temporal structure is a relatively distal antecedent of the performance and personal outcomes, several intermediate steps determine whether the time management is effective at improving performance or reducing stress. If the time management system matches the temporal structure that the individual already had, then it will not actually change the individual's temporal structure, and thus there will be no change in temporal congruity, temporal dissonance, or the final outcomes. If the time management system is different from the individual's structure, but does not improve the congruity of the individual's temporal structure with the other salient structures, it will have no effect, or a negative effect, on the outcomes of temporal dissonance. If the changes make the individual's temporal structure more congruent with salient perceived temporal structures from the environment, only then will the system finally show improvement in outcomes. Therefore, if the time management structure can be made to override the internal structure, AND the time management structure is congruent with external structures, AND it is salient, then that particular time management technique will help.

> *Proposition 4: Time management systems will only improve outcomes if they modify an individual's temporal structures in such a way as to increase salient temporal congruity.*

Temporal Dissonance Increases Use of Time Management Systems, Which Feeds Back to Alter Temporal Structures

Implementation of a time management system typically requires a great deal of work on the part of the individual. They are trying to overlay a new practice on top of their trait-based

temporal structure. Because of the effort involved, they will not have any strong motivation (assuming no outside coercion, such as a management mandate) to implement such a system if they do not feel any discomfort from mismatched temporal structures; i.e., if they feel no temporal dissonance. If, on the other hand, they do feel temporal dissonance, they will be much likelier to be willing to try to make changes that will reduce their temporal dissonance. Inherently then, a feedback loop, from high temporal dissonance, drives time management use, which modifies temporal structures, and thus changes temporal congruity. We expect that generally, individuals will only do this if the time management system increases congruity for the temporal characteristic(s) which are not congruent with the perceived environmental temporal structures.

> *Proposition 5: Increased temporal dissonance leads to use of time management systems, which change the temporal structure state, such that temporal congruity with perceived environmental temporal structures increases, thus reducing temporal dissonance and reducing negative personal and work outcomes.*

Discussion

We began our work with the mystery of why there are so many time management systems, and why previous work has not been able to unambiguously support their use. Through the development and elaboration of the model of temporal dissonance, we provide an explanation. Without an understanding of how temporal dissonance is generated and works, attempts to remedy the negative consequences of temporal dissonance had to proceed on a trial-and-error basis. The latest and greatest time management system comes on the market, causing many people suffering temporal dissonance to implement it. For some, this works, and they

become advocates for the system that worked for them. For others, the new system does not fix the parts of their temporal structures that are actually causing the problems; and they end up looping around, looking for a new time management system.

By understanding how temporal dissonance generates negative outcomes, and what causes temporal dissonance, we can now begin to imagine tools which might make it possible to choose an effective time management system based on the actual underlying problems, rather than simply trial and error.

Despite the fact that our focus has been on the individual, our theory provides some interesting potential consequences across levels. In particular, it has been noted that periodic face-to-face meetings improve performance in distributed teams (Maznevski & Chudoba, 2000). This kind of entrainment works by modifying the temporal structures of the team members; their temporal structures are brought into closer alignment with each other, and thus the team performance improves (Ancona & Chong, 1996; McGrath, 1991; McGrath & Kelly, 1986).

However, our theory provides a counterintuitive prediction as well. Entrainment works by synchronizing team member perceptions of the team temporal structure. This may reduce temporal dissonance at the team level, which may improve performance, all else being equal. However, increasing temporal congruity in a team may create other effects that must be considered. For example, entrainment might increase temporal congruity by synchronizing the actions of the group members, but then the reinforced group temporal structure may conflict more strongly with the temporal structures of individual team members, creating even less temporal congruity at the individual level. If this decrease causes discomfort in team members, then overall temporal dissonance may have increased as a result of entrainment. The increase in

individual temporal dissonance will impact the performance of the individual team members. If the total reduction in performance at the individual level is greater than the increase at the team level, overall performance may go down as a result of the entrainment. This distinction reveals that temporal dissonance is not simply the inverse of temporal congruity; small changes in temporal congruity due to entrainment may cause complex, and possibly inverse, changes in temporal dissonance.

Scientific Implications

Our initial research question asked, "What mechanism underlies the relationship between temporal incongruity and individual outcomes?" It is well established that congruent time structures generally result in better individual performance in teams and organizations, but we lack an understanding of which processes effect this outcome. With this research, we provide a partial explanation based on temporal dissonance, which occurs when salient temporal structures lack congruity. For an individual employee, high temporal dissonance leads to more negative personal and work outcomes. This link opens several interesting research possibilities.

First, we have presented a theoretical model for the new construct of temporal dissonance. We locate it in an immediate context, in the relation from temporal structures to negative outcomes at the individual level. We consider our argument persuasive, in that it explains some previously contradictory research, but empirical verification would obviously strengthen our theory. In particular, a temporal dissonance scale that operationalizes the construct could significantly assist further research. Such a measure also might confirm the existence of temporal dissonance and its place in the nomological network, which would support a better characterization of the impact of temporal dissonance in the workplace. It also would enable

more thorough investigations of distal antecedents (e.g., temporal characteristics), a better understanding of which circumstances create salience, and a clearer understanding of the consequences for workers and employers. As a new construct, temporal dissonance requires measurement in an experimental setting, to support the manipulation of the proposed antecedents. The burgeoning use of neuroscience techniques might be helpful in this sense; because temporal dissonance is an affective response, its activation should be visible in the form of altered neural activity.

Second, we shed some light on the time management paradox. Much research considers the efficacy of time management techniques, though with mixed results. Temporal dissonance helps explain both how time management actually works, and why it sometimes fails. Time management techniques (e.g., entrainment) can increase temporal congruity, but as we have noted, simply increasing temporal congruity does not necessarily increase performance. It does so only in situations in which the lack of temporal congruity is salient and thus has created temporal dissonance. That is, time management techniques reduce temporal dissonance by increasing congruity only if congruity is salient. Furthermore, without a lack of congruity, time management cannot increase congruity, so it cannot reduce the already low temporal dissonance; there is simply no benefit. If there is a lack of congruity but it is not salient, increasing congruity does not reduce the already low temporal dissonance. Only when there is some lack of congruity that calls for time management techniques , and that lack of congruity is salient, will the use of time management techniques reduce temporal dissonance. This interaction helps explain why the efficacy of time management techniques has been unclear in prior research.

Third, by incorporating multiple characteristics in a single framework, we offer

researchers a means to examine situations in which temporal structures lack congruity more thoroughly. Most research to date has focused on single temporal characteristics; our framework makes clear that differences in one characteristic may not create issues for individuals or groups. As a corollary, multiple characteristics with slight incongruities may create more temporal dissonance than single characteristic differences. Multiple characteristics and temporal dissonance thus should be included in further temporal congruity research that aims to understand the consequences of those differences.

Fourth, we have focused on the individual level, yet the concept of temporal dissonance likely plays roles at the team, organizational, and even institutional levels. Because teams create shared cognition through individual members, similar forces should be at work when team members interact, creating potential conflict among team members regarding the team's concept of time, which then may result in team temporal dissonance. Teams within organizations also may compete to create organizational time structures, leading to potential organizational temporal dissonance. Organizations then contend to define broader senses of time, perhaps creating institutional temporal dissonance. This level even could extend to broad cultural clashes, in line with the notion of culture-wide characteristics (Hofstede & Hofstede, 2004).

Fifth, further work on this topic should look for moderators of the relationships that lead to temporal dissonance, and the relationships between temporal dissonance and conflict. Thus managers would gain guidelines for how to intervene to reduce temporal dissonance, or even just its impact on individual stress levels. Such moderators might indicate exactly which time management interventions work in particular situations. In our framework, we have intentionally left the question of precisely which temporal characteristics are likely most important somewhat

open. The questions of whether particular antecedents (temporal characteristics) are more problematic or if systematic differences exist in temporal characteristics also merit closer study. We have noted two classes of outcomes but without great specificity. Understanding exactly which specific outcomes are most likely (e.g. stress, cynicism, or other outcomes), and their consequences, represent areas ripe for additional future study. Many other salient relationships can influence a person as well: family, social, religious, and civic groups. These environments all might affect individual temporal dissonance, and thus personal and work outcomes..

Practical Implications

This research identifies a set of individual characteristics that likely affect how people interact with an organization and their environment at large. In modern business settings, discrimination or stereotypes based on age, sex, race, disability, or other inherent characteristics are forbidden, yet stereotypes based on temporal characteristics are commonplace. Understanding that such differences reflect people's physical and psychological essence, rather than moral traits, may help improve relationships in teams with varying temporal structures. A recognition of such differences, as well as realizing how they can and cannot be modified, also should help produce interventions that can reduce employee stress, increase employee performance, and improve affective results (e.g., turnover, negative affect, motivation).

With a better understanding of temporal dissonance, managers also gain a clearer picture of how they might reduce employee stress. With less temporal dissonance, employees should be happier and perform better. Because temporal dissonance results from the interaction between salience and temporal congruity, a manager can intervene by reducing salience or by increasing temporal congruity. Having reduced temporal dissonance, a manager also will have improved

employee welfare and performance.

Conclusion

With this research, we contribute to a better understanding of the environmental and internal forces that underlie time and time management. By starting with a broad survey of the notion of time, we have tried to open the black box that enclosed temporal congruity and individual outcomes. We also integrate a nuanced adaptation of cognitive dissonance theory that incorporates the conflicting requirements created by multiple temporal structures. This richer framework outlines affective reactions that people likely have to temporal aspects of their environment. Temporal dissonance thus should prove to be a useful lens for future theory development and a better understanding of how managers can improve the uses of time in their organizations.

Essay 2: "You Want It When?" How Temporal Dissonance Contributes to IS Project Failure

Abstract

Project failures continue to dog business. These failures are often due to relational, scheduling, and motivational problems. In exploring how these might relate to one another, we develop the concept of temporal dissonance-- the affective reaction to a salient lack of temporal congruity-- which we expect to cause stress and cynicism. Because of the requirements of IS work, we expect it to attract people with certain temporal characteristics. However, managerial work will tend to attract people with differing temporal characteristics. This leads us to expect an increased level of temporal dissonance, and thus stress and cynicism, among IS workers. To test our theory, we first develop a measure for temporal dissonance. Then we use this measure, and measures of stress, cynicism, and temporal characteristics, to examine IS workers and managers. We find that IS workers are more likely to be owls, and to have lower time urgency than managers. We find that these are linked to higher levels of temporal dissonance, stress, and cynicism, and lower willingness to meet deadlines in the IS workers.

Introduction

Failure of IT projects continues to be a significant problem in the business world. In 1995, The Standish Group report estimated that over 30% of IT development projects would be cancelled, and more than half would cost nearly twice the original estimate (The Standish Group 1995). The picture has not improved much: failures are currently estimated at 24%, and cost over-runs exceed $6 trillion (Sessions 2009). In a study of 99 failed projects, undermined

motivation, scheduling issues, and poor working relationships among team members affected 37% of those failed projects (Nelson 2007). Reducing these personnel driven failures would provide significant returns to business.

Stress is a common source of motivational and relational problems. Researchers have explored temporal characteristics at the organizational level, detailing the effects of a lack of temporal congruity may cause, including stress and negative affective reactions (Bluedorn and Denhardt 1988; Ryan 2008; Standifer and Bluedorn 2006). Individuals with time structures incongruent with those of their organization suffer stress, leading to health effects and poor performance (Cotte, Ratneshwar, and Mick 2004; Kaufman, Lane, and Lindquist 1991; Slocombe and Bluedorn 1999). To remedy this, suggestions for improving congruence include entrainment and time management techniques, with the expectation that these would also improve individual performance. While the cited works consider several different notions of time, such as polychronicity, temporal focus, and time urgency, the complexity of time itself suggests that many more temporal characteristics might be important (Ancona, Okhuysen, and Perlow 2001).

If a group of workers tends to have temporal characteristics which do not match more traditional white collar worker profiles, the lack of temporal congruity may severely aggravated. We believe that this tendency to incongruity can be found in IT workers. As an example, consider the temporal characteristic of chronotype. People whose cortisol levels rise later in the day ("owls") seem to be somewhat more creative than their morning ("lark") counterparts, while larks are somewhat more conscientious than owls (Giampietro and Cavallera 2007). Greater creativity would be useful in creative work such as IT project implementation, but is less of a

competitive advantage for the relational work of management. Being more conscientious, on the other hand, would be of advantage in management. Thus, it may be that owls may be more drawn to IT work, and larks to managerial work. We propose a theory which may help to understand how these temporal characteristics work, providing a mechanism by which temporal congruity changes stress and cynicism.

Such a theory requires attention to the underlying psychological or social mechanisms by which this lack of congruence affects performance, an area which has not yet been widely explored. One possible explanation for the effect that a lack of temporal congruity may have on performance is the concept of temporal dissonance. Temporal dissonance is the affective reaction an individual has to a salient lack of temporal congruity (Conway and Limayem 2010). Distributed teams are at a higher risk of developing temporal dissonance due to both cultural differences (G. Hofstede and G. J. Hofstede 2004) and physical time differences (O'Leary and Cummings 2007) – in addition to the individual differences that are already known to be a problem in teams. Detecting temporal dissonance in a distributed team would allow the manager an opportunity to address the temporal challenges to the team, and thus improve the team's functioning. However, no method for detecting temporal dissonance currently exists.

Our research question, then, is: Does temporal dissonance help explain project failures? In order to start to answer this question, we have four objectives: 1) develop a measure of temporal dissonance; 2) demonstrate the consequences of temporal dissonance; 3) show how IT workers and managers differ in systematic ways that result in built-in temporal dissonance in IT workers; and 4) connect our model to willingness of IT workers to meet deadlines. A reduction of willingness to meet deadline will increase the possibility of project failure. Thus, temporal

dissonance is a contributor to project failure. To implement these objectives, we first develop a definition of temporal dissonance. We then develop a model which shows how differences in temporal characteristics lead to temporal dissonance, and how temporal dissonance increases stress and cynicism, which are known to have performance impacts on IS development. We then test this theory through a series of studies. In these studies, we begin by developing a measure for temporal dissonance and related constructs. We then validate the model, showing that temporal dissonance results from an interaction between temporal congruence and salience, and that it is associated with increased stress and cynicism. We then show that some temporal characteristics differ between IS workers and managers, and that IS workers do experience more temporal dissonance than managers, which leads to IS workers suffering more stress and cynicism. Finally, we show that an increase in stress and temporal dissonance reduces workers' willingness to meet deadline, contributing to the possibility of project failure.

Our paper is structured as follows. We first examine the prior work in more depth in the "background" section. We then break the work into sections for each of the objectives. In each objective section, we extend the development of our theory in the "model" section; we describe the instruments we designed and used, and the data collection method, in the "method" section; the results are presented in the "results" section; and we conclude each objective section with a brief discussion. The paper concludes with implications for theory and for practice, and points toward avenues for future research in the "Overall discussion" section.

Background

Most research views time as an immutable and objective measure of the distance between two states. This view, however, is relatively new, and was created largely through the

industrialization of the Western world, as a tool for turning labor into a commodity (Sorokin and Merton 1937). Prior to that, time was viewed more fluidly: years from an event, seasons, recurring markets. In recent years, researchers have realized that time is a more important, and more complex, element of research, which requires a careful analysis of the assumptions underlying its use. To many business people, time is a real object which can be manipulated or used in various ways. In one study, engineers were observed in many activities related to manipulating time, including making time, exchanging time, exploiting time, investing time, spending time, extending time, and documenting time (Yli-Kauhaluoma 2009). Successful innovators view time as something which exists and can be used, enacted and affected in many ways; in fact, this may be a source of their success in innovation, as it may be impossible to untangle time manipulation from innovation (T. Hellström and C. Hellström 2002). It seems clear that, rather than a simple yardstick, time is a complex and essential element when examining business processes and developing theory (Street and Ward 2011).

Time can mean many different things, depending on the context. An early framework differentiates between social time, astronomical time, and economic time (Sorokin and Merton 1937). A newer framework divides time into social time, mathematical time, or economic time (Bluedorn and Denhardt 1988). Yet another framework subdivides the Bluedorn and Denhardt "social time" into three primary categories: conceptions of time, socially constructed time, and actors relating to time (Ancona et al. 2001). These frameworks are by no means exhaustive; none of them include (for example) biological time, rooted in the physical body. In order to understand why time is so complex, let us briefly examine several types of time.

Biological time is rooted in biological processes such as circadian rhythms, seasonal

variation, and life stages. Circadian rhythms affect chronotype: how individuals structure their day, including waking and sleeping hours. Owls (an evening chronotype) prefer to start work later in the day, and work into the evening, while larks (a morning chronotype) are "early birds" who try to start work as early as possible. These differences are physiological, and can be measured by cortisol levels. Peak cortisol levels have implications for when individuals perform best (Horne, Brass, and Pettitt 1980). Larks tend to have a high early morning peak in cortisol levels, with production dropping fairly quickly in the afternoon. Owls tend to have a later, and flatter, peak, with production continuing at moderate levels into the evening (Kudielka, Federenko, Hellhammer, and Wüst 2006). While it is easy to see fluctuations in our moods and capabilities through the course of a day, there are even broader patterns of changes as well. For instance, seasonal changes are not as obvious in people as they are in maple trees, whose leaves turn color and drop off in the fall. However, illnesses such as Seasonal Affective Disorder are caused by the same differences in the seasons that cause leaves to turn and fall (Mayo Clinic Staff 2009). Life stages can be as obvious as insect development from egg to larva to nymph to adult, or as subtle as the development of humans from infancy through youth to maturity and old age.

Psychological time deals with the subjective nature of time which is unique to an individual. The Type A personality exhibits a characteristic of time urgency (Landy, Rastegary, Thayer, and Colvin 1991; Waller, Conte, Gibson, and Carpenter 2001). Time perspective or focus deals with the propensity of an individual to focus on the future, the present, or the past (Zimbardo and Boyd 1999). Polychronicity refers to a preference for undertaking multiple tasks at once; monochronicity is a focus on one task at a time (Kaufman-Scarborough and Lindquist

1999). These are only a few of the most commonly used psychological models of time; there are many others which can be applied when circumstances warrant (Ancona et al. 2001).

At the aggregate social group level, these traits interact with other individuals' traits to create *social time*. Social time structures an individual's interactions with the social groups surrounding her. Social time is both created from, and is input into, psychological time, in a feedback loop. Thus, social time is constructed as a shared model of time between two or more people (Ancona et al. 2001; Sorokin 1964). These structures are created by incorporating psychological time with the temporal requirements of the social groups, organizations, or institutions in which the individual finds herself (Blount and Leroy 2007). Different groups may have different social time characteristics; for instance, family social time may be organized around birthdays, anniversaries, or important holidays, while work social time may revolve around quarters, years, or busy seasons (Bluedorn and Denhardt 1988). All these social times may be in effect at any point in time, depending on which is salient. Conflicts between them can set up stress and may trigger affective reactions in the individuals involved (Ryan 2008), which may also have implications for the organization itself (Slocombe and Bluedorn 1999). Cultures, too, have models of time, such as long-term outlook (G. Hofstede and G. J. Hofstede 2004). Cultural outlooks on time have an impact on social time as conceived by both individuals and the groups, organizations, and institutions embedded within the culture.

Physical time is based upon the underlying physical world. It is seen as objective reality which does not arise out of an organism's biological nature. The current definition of a physical time second as 9,192,631,770 wavelengths of a cesium atom (NIST 2009) is an example of this kind of time; another is the definition of the second as 1/86400th of the time from one solar noon

to the next. Reconciling these two definitions often requires the creation of "leap seconds" to keep the two differing measures synchronized, and arguments often occur about whether or not those adjustments should be made. Physical time interacts with other types of time: for instance, jet lag occurs when circadian rhythms (biological time) are disrupted as a traveller changes her position in physical time (Arendt and Marks 1982).

These differing interpretations of what time actually is underscore the need to consider time as an essential element when examining business processes. Because of the implied manipulability of time, there is a tendency among individuals to make value judgements about competing time structures, perceiving them as evidence of personality flaws (Ryan 2008). American society values morning people. Contemporary media is biased towards the polychronic individual. Being aware of time complexities and adjusting the workplace to cope with them can improve a leader's ability to drive organizational innovation and creativity (Halbesleben, Novicevic, Harvey, and Buckley 2003).

Individuals create complex mental models of time (called temporal structures) out of all these temporal characteristics, which help them to order and organize their lives. Temporal structures take trait-based and environmental information as inputs, and instantiate them as a state in the individual. Individuals may have multiple temporal structures to deal with different aspects of the world (Orlikowski and Yates 2002). For instance, one can have one temporal structure for organizing one's interaction with family, and a different one for organizing interactions with the workplace. Individuals' temporal structures are created through interaction between their environment (including culture, organizational ties, institutional memberships, and familial ties) and their own personal psychological and physiological characteristics (Blount and

Leroy 2007; Clark 1985; Saunders, Van Slyke, and Vogel 2004). Being a state, temporal

structures are malleable, but will have a tendency to return to values supported by the underlying

traits. These temporal structures may sometimes conflict with each other in ways that can cause

individual stress – thus the concern with "work-life balance" (Orlikowski and Yates 2002). This

stress can lead to reduced individual health and performance (Bluedorn and Denhardt 1988;

Slocombe and Bluedorn 1999).

Temporal congruity can be defined as the degree to which two temporal characteristics

match (Kaufman et al. 1991). Similarity in polychronicity of the individual and the organization,

for instance, can improve both individual and organizational outcomes (Kaufman-Scarborough

and Lindquist 1999). Other studies have similarly showed the value of temporal congruity for

other time dimensions, both in terms of the positive value of congruity (Standifer and Bluedorn

2006) and the negative impact of lack of congruity (M. P. E. Cunha and R. C. E. Cunha 2004). In

fact, technology can even have temporal characteristics. When the technology's temporal

characteristics are congruent with the way that an individual intends to use the technology, the

technology improves individual performance (Te'eni 1992). This relationship is strong enough

that the temporal characteristics of a technology and an intended task can be used to predict what

form of media individuals will use, such as choosing between using the telephone or using voice

mail depending on how reactive the user wishes to be (Rowe and Struck 1999). In their work,

Rowe and Struck find that when a user wishes to be more reactive, they will prefer to use email

rather than a telephone. This is because email does not require synchronizing between the two

people communicating, so can provide an exchange of information with less lag time than voice.

Why does this congruity matter? Surely the simple congruence of time dimensions does not, in

and of itself, improve outcomes. However, no mechanism for temporal congruity's effects have been identified. What happens when two time structures are incongruent? How do they become congruent? And does lack of congruence on multiple dimensions lead to more trouble than a lack of congruity on only one dimension? Several of these studies give useful clues as to the mechanisms behind the problems. First, individuals seem to feel distress when they have conflicting time structures, and perform actions to reduce that distress (Cotte et al. 2004). Second, conflict seems to emerge when temporal structures are not congruent (M. P. E. Cunha and R. C. E. Cunha 2004; Gersick 1988; Labianca, Moon, and Watt 2005; Ryan 2008).

The actions taken to reduce the stress of competing time structures in Cotte et al. (2004) included emphasizing certain time characteristics, and downplaying others. In organizations, individuals often force themselves to cope with competing temporal structures when they do not have the power to alter them, or negotiating changes when they can (McGrath 1991). These behaviors are very similar to the coping behaviors associated with the reduction of cognitive dissonance. Cognitive dissonance (Festinger 1957) is the discomfort felt when an individual holds two conflicting psychological models. The classic example of cognitive dissonance is the person who smokes, even though she knows that it increases the likelihood of early death. Individuals will attempt to reduce this discomfort by reducing the salience of beliefs that are dissonant to the desired attitude; adding consonant beliefs to strengthen the desired attitude; or attempting to change the dissonant beliefs to remove the dissonance (Aronson 1969).

The behavior of individuals with salient incongruent temporal structures is similar to that of individuals suffering from cognitive dissonance, and the incongruent temporal structures are similar to the incongruent cognitions that cause cognitive dissonance. Therefore, we call the

psychological discomfort felt when an individual internalizes two or more temporal structures that lack congruity temporal dissonance. Temporal dissonance may be created from differences in physical, biological, social, or psychological time, or any combination of those, when those differences are made salient. Temporal dissonance requires an affective reaction to the temporal incongruity. The concept is similar to the difference between psychological contract breach, and psychological contract violation. The former is the simple fact of a broken psychological contract, while the latter is the affective reaction to the breach (Morrison and Robinson 1997).

This discussion has provided the background we need to explain our model of what temporal dissonance is and how it works.

Objective 1: Developing a Measure of Temporal Dissonance

Objective 1 is to define a measure for temporal dissonance. Figure 6 summarizes the model we use to do this. In this very basic model, we are simply trying to show construct validity of the measures to be used. To do this properly, we include the previously seen relationship between temporal congruity and stress, expanding it by including the moderating construct of salience and the mediating construct of temporal dissonance. The following sections detail and explain this model.

Figure 6: Model Summary for Objective 1:
Develop a Measure for Temporal Dissonance
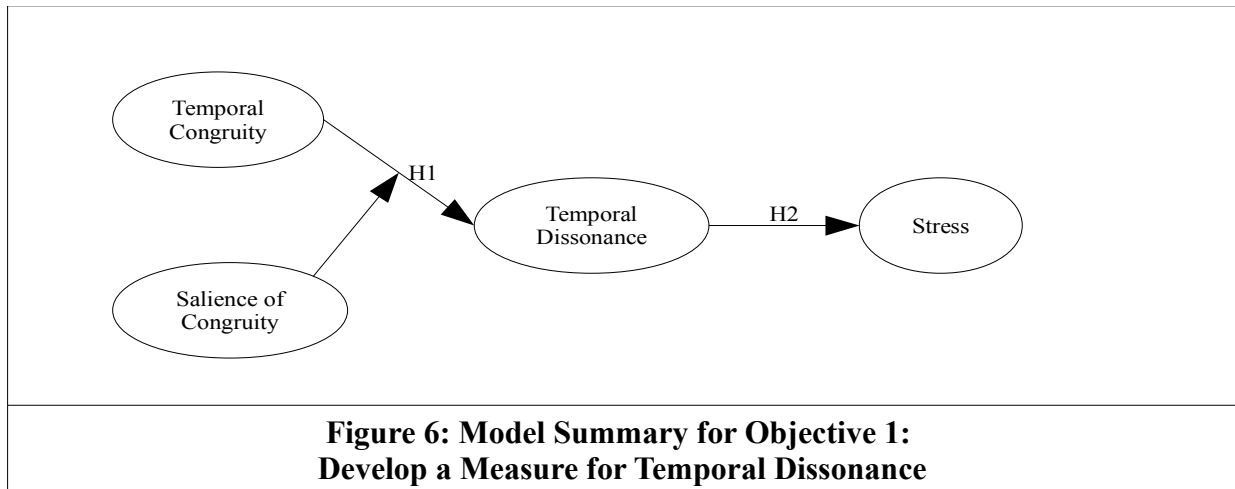
Theoretical Model

The Effect of Temporal Congruity and Salience on Temporal Dissonance

Past work has shown that, for individual temporal characteristics, differences between an individual's characteristic and that of their workplace can increase stress on to the individual. This happens because the individual has a natural way of working (Saunders et al. 2004). When they work within that natural rhythm, they do not experience any particular difficulties. When they are required to work outside their natural rhythm, they experience stress, and the consequences that come from stress. This can be seen most clearly in studies of shift work. Workers that work second or third shift suffer from more stress, leading to poorer health, higher accident rates, and lower productivity (Folkard, Lombardi, and Spencer 2006).

However, it seems unlikely that it is simple lack of congruity that causes the problem. Consider two IT working groups at the same company, with the same manager. Without loss of generality, assume that all the IT workers are owls, and that the manager is a lark. To the first group, the manager (Larry) tells his workers: "This company is paying you a lot of money. They

pay me to make sure that you're worth that money. Because of that, I need to you to work the same hours that I do. I'm a morning person, so I'll expect you to be here, in your seat, and working, from 7am until 4pm, just like I am." In the second group, Larry tells his workers: "This company is paying you a lot of money. They pay me to make sure that you're worth that money. Because of that, I need you to keep a time card. I don't care what time you work, but I need to see eight hours of work time every work day on your time card."

It is obvious that the second group will be under considerably less stress. While they are still under orders to work their eight hours, and have a small incremental nuisance in keeping a time card, they will be able to work at the time that they feel the best. They can come in at noon, work until nine, fill out their cards, and not suffer stress due to working at times that do not suit them. This is why simple lack of congruity does not explain stress differences. Both groups of workers have exactly the same temporal congruity with respect to chronotype (and the other factors will vary randomly, or be controlled since they have the same manager). The first group, however, suffers much more stress, due to the fact that they are having to work at hours during which they are not at their peak performance level.

The missing link is that the difference between the temporal structures is not enough to create stress on its own. The difference has to be made salient. Specifically, the worker must be under some requirement to internalize a temporal structure which differs from their own. When this happens, they feel discomfort because of the clash between the structures. In the case of our example, the first group wants to work later in the day, but is being forced to work early in the morning. They have to observe the temporal structure of their manager, and feel uncomfortable because that makes them work at hours they'd rather not. The difference has been made salient.

The second group, while they are aware of the differences between their chronotype and Larry's, are not forced to adapt to Larry's chronotype. They lack congruity with him, but do not feel discomfort, since they can still work later in the day. The lack of congruity is not salient.

While this example has been purely about chronotype, we expect that other temporal characteristics will interact in similar ways. We further expect that slight differences on any particular characteristic may not cause difficulty, but when combined with slight differences on other temporal characteristics, salient incongruities can rise to the level where difficulties occur. Because of this, it makes sense to consider congruity between the totality of a person's temporal structure, and the temporal structures that the individual may encounter, and to consider the salience of those external structures. When the congruity between the structures is low, and the salience is high, we would expect the person to experience considerable discomfort. When the congruity is high, the salience should not matter, as there will be no differences to be felt; the individual feels no discomfort in complying with temporal structures that match her own. Similarly, when the salience is low, the differences do not matter, so no discomfort results. As we defined previously, this discomfort, when felt, is temporal dissonance. Thus, we arrive at our hypotheses that temporal congruity combines with internalization requirements to create temporal dissonance. To clarify our interaction hypotheses somewhat, they are also summarized in Table 2.

Table 2: Hypothesis 1 Summary		
Salience	Temporal Congruity	Temporal Dissonance
Low	Low	Low (H1C)
High	Low	High (H1A)
Low	High	Low (H1B and H1C)
High	High	Low (H1B)

H1A: When the temporal congruity between an individual's temporal structure and one or more external temporal structures is low then, if the salience is high, the lack of congruity will cause high temporal dissonance in the individual.

H1B: When the temporal congruity between an individual's temporal structure and one or more external temporal structures is high, temporal dissonance will be low, regardless of the salience of the external temporal structure.

H1C: When the salience of all external temporal structures is low, the individual's temporal dissonance will be low, regardless of the congruity of the temporal structures.

The Effect of Temporal Dissonance on Stress

When an individual has the affective reaction of temporal dissonance, they feel uncomfortable. They are being forced to try to resolve conflicts between their own temporal structure and those that have been imposed on them from without. When Larry insists that Ondine make an early meeting, she will be waking up in the morning earlier than she likes. She may find it difficult to get enough sleep, because it may not be possible for her to get to sleep early enough in the evening to be fully rested when she has to go in to work. Alternatively, she can work on her preferred schedule, but suffer repercussions from missing the meeting. Either option is distressing to Ondine, and having to make this choice causes her further stress. This

stress can be physical (like when she wakes up early to get to the meeting), psychological (when she chooses to miss the meeting), or even both (she wakes up early, makes the meeting, and is thus embarrassed when she falls asleep during it). Either choice will produce the physiological effect of stress. Thus, we see that higher levels of temporal dissonance lead to higher levels of stress. Stress is well-known in the literature to cause reduction in motivation, an increase in neuroticism and turnover intention, and a negative impact on the individual's health.

H2: An increase in temporal dissonance in an individual increases the stress felt by the individual.

Method

We took several steps in the development of the scales for temporal dissonance, temporal congruity, and salience of temporal congruity, in accordance with the accepted scale development procedure (DeVellis 2003; MacKenzie, P. M. Podsakoff, and N. P. Podsakoff 2011). In the first step, we created a pool of items by brainstorming with subject matter experts. We then subjected this pool of items, along with some similar items which should not be part of these measures, to a card sort by Ph.D. students. Their sort generally agreed with the pool items, eliminating two weak items. This left nine items for temporal dissonance, five for temporal congruity, and three for salience. These items are listed in Table 3. Note that the items for temporal congruity are all reverse-coded; we did this in order to simplify the analysis. Therefore, a high score on the measured variable indicates low temporal congruity. We then had two panels complete a survey including those items and previously developed items for measuring stress (Cohen, Kamarck, and Mermelstein 1983). We collected data from two sources. The first sample consisted of students at a large southern university, who were offered extra credit for

participation. The second set of respondents was gathered from paid volunteers solicited on Amazon.com's Mechanical Turk. In the Mechanical Turk system, individuals self-select based on the description of a task and the payment for the task. The description offered for this task was "take a survey for an academic study", and the payment offered was $0.10 for completing the survey. For this initial sample, the only demographic variables collected were age and gender. We did not collect any grouping information (e.g., IT experience or managerial experience) for this set. The two samples did not significantly differ in gender or age, so we pooled the data for analysis using the R statistical package. Since the primary goal of the first study was simply to verify the factor structure of the new measures, we did not consider it desirable to consider other demographic items or IT experience. Further, since the constructs of interest are likely to be common to any individual, a convenience sample should be adequate to the task of measure development. The primary reason for using both students and Mechanical Turk respondents was to increase the sample size in order to be able to properly evaluate the measurement model.

Results

We initially had 721 responses to the survey. After removing responses in which items were not completed, we had 636 complete responses. Four of those responses were missing a response to the gender question, and 44 to the age question. We replaced those NA responses with median values, as the demographic responses are intended for use as controls, and are not the focus of the study. Of those responses, 54 were from students, and 582 were from the Amazon Mechanical Turk. These two subgroups did not significantly differ on age or gender, so we pooled the data for the analysis.

Table 3: Measures Used		
Construct	Tag	Item
Temporal Congruity	con0	There are demands on how I use time that conflict with each other
	con1	Those around me want me to use time in ways that conflict with each other and / or myself
	con2	I have to balance conflicting demands in the way I use time
	con3	Those around me structure time differently from the way I do
	con4	There are conflicts in the way those around me want me to use time
Salience of Temporal Congruity	sal0	It is important that I use time in a way that fits with the people I work with
	sal1	I have to pay attention to how those around me use time
	sal2	I feel pressured to structure my time as others do
Temporal Dissonance	diss00	I feel uncomfortable because I have conflicting demands on how I use time
	diss01	It bothers me that I have conflicting demands on how I use time
	diss02	Conflicting requirements in the way I structure time is upsetting me
	diss03	I am distressed because I have conflicts in the demands for how I use time
	diss04	Resolving conflicts in the way I structure time is bothering me
	diss05	Balancing requirements on how I use time causes me discomfort
	diss06	Conflicts in demands for how I use time is upsetting me
	diss07	I am uncomfortable because people around me want me to use time differently
	diss08	I feel unhappy because people don't understand how I use time
Stress		Cohen et al. 1983 items (positive items only, no reverse-coded items)

For the next step, we removed data points which were outside the distribution of a χ^2 test for multivariate normality using all data that was collected. This was done in an iterative manner; first, the Mahalanobis distances of all the current data set were calculated, and then the expected distances from a χ^2 distribution. The furthest outlying point was compared to the largest expected distance, and deleted if it was larger. The process then continued by recalculating the

Mahalanobis distances, and repeating this procedure, until the most extreme point was within the expected distribution. This left a total of 509 data points to continue the analysis. Of these, 35 were student responses, and the remainder were Mechanical Turk responses.

We then constructed a measurement model for SEM analysis, using R version 2.15.0 and the lavaan package (R Development Core Team 2011). Items were loaded onto their appropriate constructs, and the constructs were allowed to covary. We created two method variables, one for positive, and one for negative items, which were allowed to covary with each other. We did this because several of the stress scale items are reverse coded, and there is some concern that scales with reverse coding may suffer from instrument-related artifacts (Roszkowski and Soven 2010). Our initial run indicated that that fear was well-grounded. The reverse-coded stress items loaded strongly onto the negative method factor, and only weakly on the stress factor. Because of this, we removed all the reverse coded stress items, and reduced the method variables to a single common method variable. This resulted in a model with good fit criteria. Good criteria for measurement model fit are CFI greater than 0.95, RMSEA less than 0.06, and SRMR less than 0.08 (Hu and Bentler 1999). For the unreduced model, we had a CFI of 0.967, RMSEA of 0.0396, and SRMR of 0.0316, indicating an acceptable fit.

We performed the rest of the analysis using SmartPLS 2.0 (Ringle, Wende, and Will 2005). We constructed the basic model and then proceeded to examine weights and significance for the items. We eliminated items with low weights or p-values, and those with high cross loadings. This process was done one item at a time; after eliminating an item, the model was re-evaluated for the next candidate for removal. As a result, items sal00 and con03 were eliminated. The final model fit well, with high R2, path coefficients, and p-values. We then calculated the

composite reliability and AVE for each of the variables. These are presented in Table 4

(reliability) and Table 5 (correlations). Our measure has adequate reliability and convergent

validity, as all variables had a composite reliability greater than 0.7, and AVE greater than 0.5.

Discriminant validity is acceptable using the Fornell-Larcker test (Fornell and Larcker 1981).

The correlation table, which has the square root of the AVE on the diagonal, shows that the

square root of the AVE is greater than than the latent variable correlations for each variable.

Table 4: Reliability and Convergent Validity			
Variable	Composite Reliability	Cronbach's α	AVE
Temporal Congruity	0.820	0.708	0.534
Salience of Temporal Congruity	0.752	0.381	0.609
Temporal Dissonance	0.906	0.884	0.519
Stress	0.853	0.799	0.468

Table 5: Correlations				
Diagonal is $\sqrt{AVE}$	Temporal Congruity	Salience of Temporal Congruity	Temporal Dissonance	Stress
Temporal Congruity	0.731			
Salience of Temporal Congruity	0.550	0.780		
Temporal Dissonance	0.698	0.640	0.720	
Stress	0.430	0.36	0.562	0.684

Having shown the measurement model was adequate, we then proceeded to the structural

model. We calculated the proposed interaction term, and ran the model. The resulting model had

high path coefficients and R2, indicating a valid model. The path coefficients were all

significant, supporting all our hypotheses. The results of the structural model are shown in Figure

7. We do not include main effects coefficients, as we did not hypothesize main effects. However, for completeness, the main effects coefficients were 0.141 for congruity and -0.115 for salience.

Figure 7: Results For Objective 1:
Measure Development Model Results (** p < 0.01)
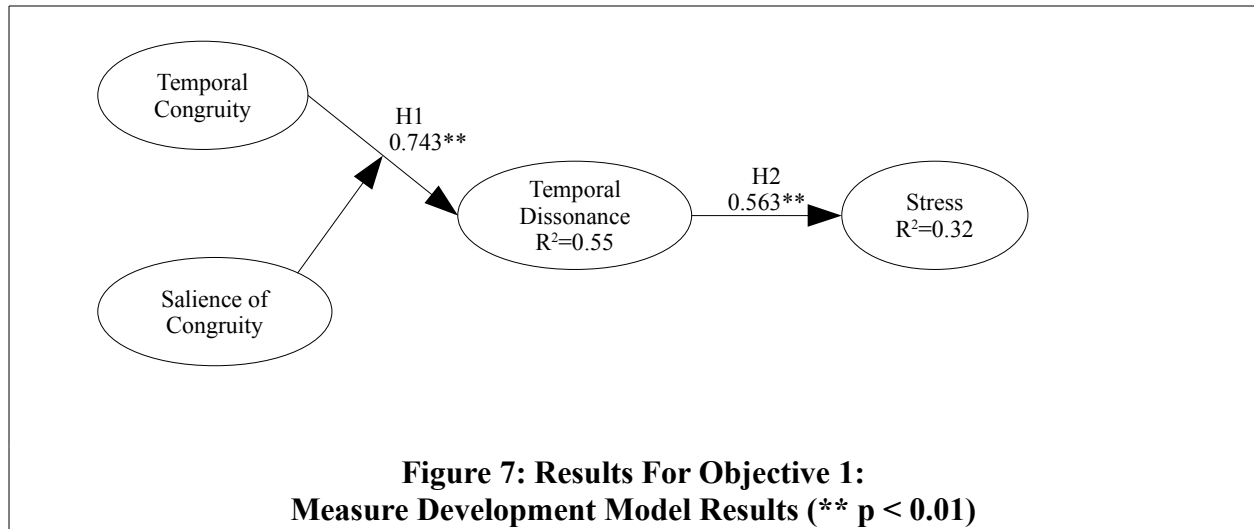
Discussion

Hypothesis 1 held that the interaction between low temporal congruity and high salience of temporal congruity would lead to temporal dissonance. The three parts of the hypothesis were intended to make the interaction clear. They are all tested by the one coefficient. We inverted the actual score for temporal congruity (such that a high value indicated low congruity), so that a positive significant coefficient indicates support for H1A, H1B, and H1C. Our finding of a coefficient of 0.743 (p<0.01) indicates that hypothesis 1 is supported. Hypothesis 2 held that an increase in temporal dissonance would lead to an increase in stress, which was also supported with a positive significant coefficient of 0.564 (p<0.01). The R2 for temporal dissonance was 0.55, and for stress was 0.32, indicating that the model is of predictive value.

Both of our hypotheses were supported. The measures are by and large quite clean, although the low Cronbach's alpha for the salience measure-- due in part to its reduction to two

items-- is of some small concern. The establishment of discriminant validity of temporal dissonance as something different from temporal congruity strongly supports the idea that temporal dissonance is a real phenomenon. Because we deleted items to improve the model, this study is exploratory and should be confirmed with a new sample using the reduced measures to ensure that we are not capitalizing on chance.

Objective 2: Demonstrate the Consequences of Temporal Dissonance

Our goal for this objective is to demonstrate that temporal dissonance has measurable consequences. While we showed that stress was a consequence in Objective 1, that section reports the exploratory study establishing the measure for temporal dissonance only. In this section, we confirm that measure, and confirm that temporal dissonance increases stress and cynicism. We also examine differences between IT workers and managers that would lead to increased temporal dissonance, and thus stress and cynicism, in IT workers. Figure 8 presents the model used for this objective.

Figure 8: Model Summary for Objective 2:
Demonstrate the Consequences of Temporal Dissonance
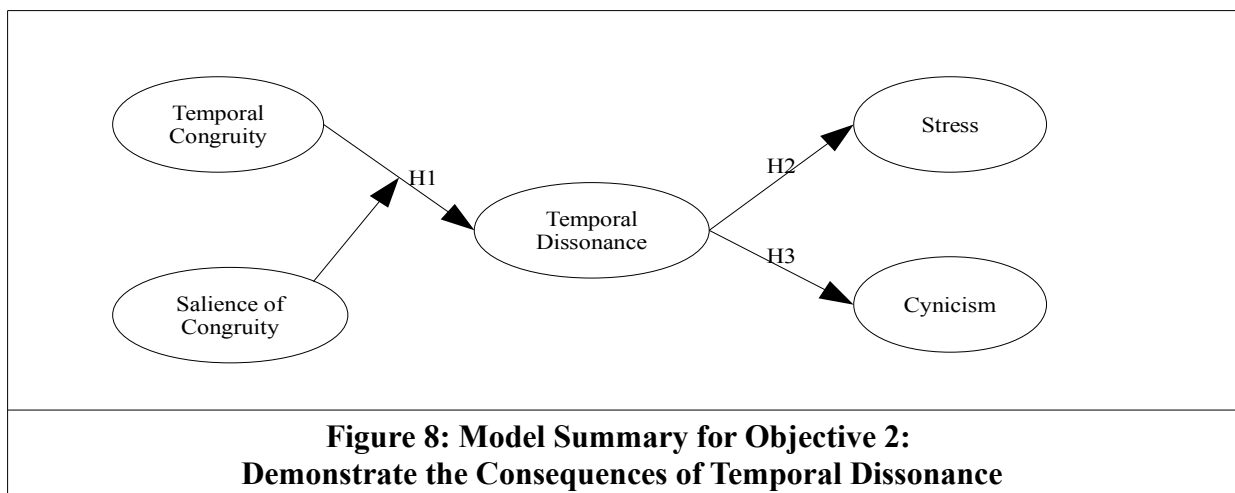
Theoretical Model

Hypothesis 1 (salient temporal congruity leads to temporal dissonance) and hypothesis 2 (temporal dissonance leads to stress) remain from Objective 1. We restate hypothesis 1 more simply, though the meaning remains the same. H2 is identical. To this we add a second consequence, cynicism toward the organization.

The justifications for H1 and H2 remain the same as for H1 and H2 in Objective 1.

H1: Temporal congruity and salience interact to create temporal dissonance; temporal dissonance will be highest when temporal congruity is low and salience is high.

H2: An increase in temporal dissonance in an individual increases the stress felt by the individual.

The Effect of Temporal Dissonance on Cynicism

Cynicism occurs when an individual feels that they are not equally valued in an organization. It tends to happen more when decisions appear to be made for emotional or political rather than analytical reasons (Kanter and Mirvis 1989). Because of the built-in personal differences they have with their manager which causes temporal dissonance, the IT worker is made to feel uncomfortable, and attributes that discomfort to the requirements placed upon her by the organization. This results in the worker feeling that they are judged for emotional reasons rather than the value they provide, leading to a feeling of cynicism.

H3: An increase in temporal dissonance in an individual will increase the cynicism felt by the individual.

Method

We extended the survey we used for study 1 with an established measure of cynicism (Kanter and Mirvis 1989). Since we planned to use the Amazon Mechanical Turk again, we added check items to ensure that respondents read and answered the questions, rather than simply filling in the survey quickly without reading. These check items allowed us to more easily find the responses which should be discarded. We collected a new sample from the Mechanical Turk, offering $0.10 for completion of the survey. From an initial sample of 637 responses, we were able to use 414 that correctly answered the check questions. We then used these responses in a SmartPLS 2.0 (Ringle et al. 2005) analysis. In anticipation of later objectives, we wished to retain only managers and IT workers for analysis. The final sample contained 156 IT workers and 138 managers.

In addition to the measures used for this objective, we also extended the survey with measures intended for use in Objective 3. We will provide more details on these additional measures there.

Results

Tables 6 and 7 report the reliability and correlations for the measures. The results corroborated the results from objective 1 for the dissonance measures. The items loaded well on their construct, and did not significantly cross-load. For space reasons, we do not report reliability and correlations of the established measure of cynicism; those results were also within acceptable values.

Table 6: Reliability and Convergent Validity			
Variable	Composite Reliability	Cronbach's α	AVE
Temporal Congruity	0.845	0.757	0.580
Salience of Temporal Congruity	0.767	0.421	0.626
Temporal Dissonance	0.925	0.908	0.578
Stress	0.877	0.834	0.525

Table 7: Correlations				
Diagonal is $\sqrt{AVE}$	Temporal Congruity	Salience	Temporal Dissonance	Stress
Temporal Congruity	0.761			
Salience of Temporal Congruity	0.514	0.791		
Temporal Dissonance	0.742	0.556	0.760	
Stress	0.398	0.268	0.528	0.724

We evaluated the structural model to test hypotheses 1, 2, and 3. The results are summarized in Figure 9. H1, that the interaction of salience and temporal congruity causes temporal dissonance, was supported ($p<0.001$). H2, that temporal dissonance causes stress, was also supported ($p<0.001$). H3, that temporal dissonance causes cynicism, was supported ($p<0.001$), though the variance explained was very small (4%). We do not include main effects coefficients, as we did not hypothesize main effects. However, for completeness, the main effects coefficients were 0.235 for congruity and -0.214 for salience. Had we hypothesized these main effects, congruity would have been significant at the 0.05 level, and salience would not have been significant.

Figure 9: Results for Objective 2:
Demonstrate the Consequences of Temporal Dissonance (*** p<0.001)
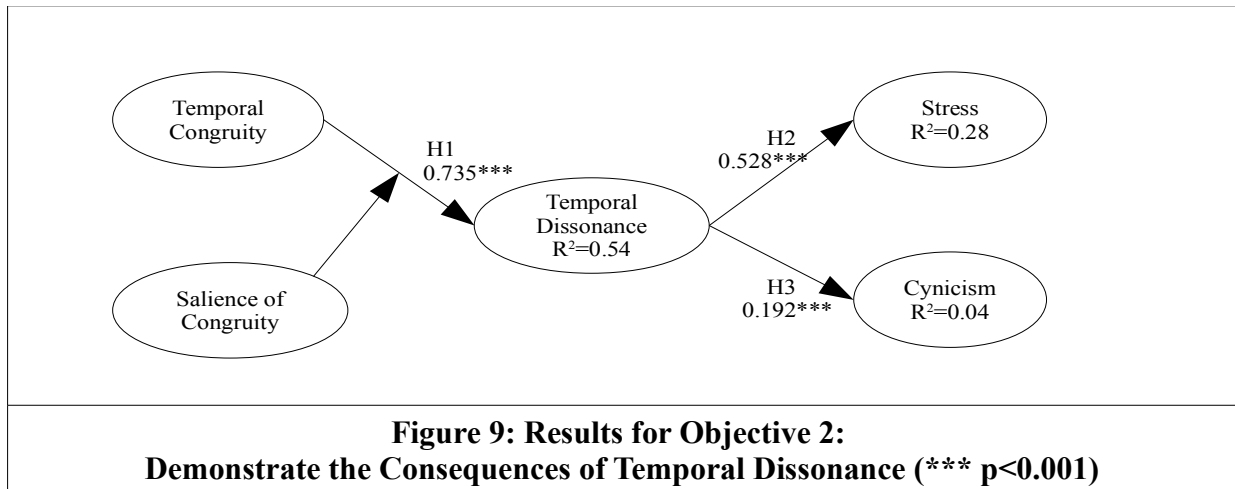
Discussion

This study confirmed the findings of the first study. This indicates that the measures introduced for temporal congruity, temporal dissonance, and salience are valid for use. The path coefficients and R2 values for this study are quite similar to those of the first study, lending further credence to the results. Finally, the study did confirm the consequences of temporal dissonance, in that both stress and cynicism were found to be significantly related. From a practical standpoint, however, the usefulness of the cynicism result is marginal, given the very small R2.

Objective 3: Establishing Differences Between IT Workers and Managers

Now that we have established temporal dissonance with a confirmatory study and shown that it has real consequences, we continue our examination by considering whether IT workers and their managers have systematic differences in temporal dissonance.

Theoretical Model

The ASA (Attraction-Selection-Attrition) framework holds that people tend to be

attracted to jobs in which the job requirements match their own attributes. They are selected for a job more often when their attributes match, and tend to leave jobs when their attributes do not fit as well (Schneider, Goldstein, and Smith 1995). In this objective, we will examine some characteristics in which job demands are different, and suggest that people that have certain characteristics will be more likely to take a particular type of job. We caution the reader, however, to not fall into the ecological fallacy. We are considering broad characteristics that tend to aid the success of an individual in a particular type of job (IS worker or manager). This does not mean that any particular individual must match those characteristics. For instance, it is not necessary for an IT worker to be an owl in order to be successful; we are simply arguing that, across the population, there is a tendency for IT workers to be owls. With that caveat, we move into our theory development.

The Effect of Worker Type on Chronotype

An individual's chronotype is their preference for morning or evening. While it has a psychological component, it is primarily derived from physical differences in cortisol levels during the day (Cavallera and Giudici 2008). Cortisol levels help to define the psychological arousal level of an individual. When cortisol levels rise, arousal increases, all else being equal. Psychological arousal results in greater alertness and greater cognitive capacity. This translates into a greater capability for engaging in work, especially in detail-oriented creative work such as programming (Giampietro and Cavallera 2007). Thus, we would expect that IT workers would work better when their arousal level is high. Since cortisol levels can raise arousal levels, higher cortisol levels would thus be desirable. In the case of larks, peak cortisol levels happen early in the morning. The cortisol level rises rapidly, then tapers off as the day wears on. This suggests

that larks' bodies release a large pulse of cortisol early in the day, with less or no cortisol released later. Consequently, they feel most capable in the morning, near the peak of their cortisol levels, and their energy fairly rapidly declines with their cortisol levels in the early afternoon (Kudielka, Bellingrath, and Hellhammer 2007).

Owls, on the other hand, have their cortisol peak later in the day. Their cortisol levels rise more slowly, and decay more slowly, resulting in peak efficiency in the afternoon or even evening (Kudielka et al. 2007). This suggests that rather than one rapid pulse, owls' bodies release cortisol at a steadier level during the day, resulting in less dramatic changes in arousal level.

It is not merely that the peak in cortisol levels happens at different times for larks and owls, but the rise and decay are also different. In the case of larks, the cortisol level rises sharply early in the day, and then decays in a seemingly exponential fashion. In the case of owls, the rise and fall are both slower, with a slightly lower peak value, resulting in a broader plateau of high cortisol (Kudielka et al. 2006). Graphically this can be compared in Figure 10 below.
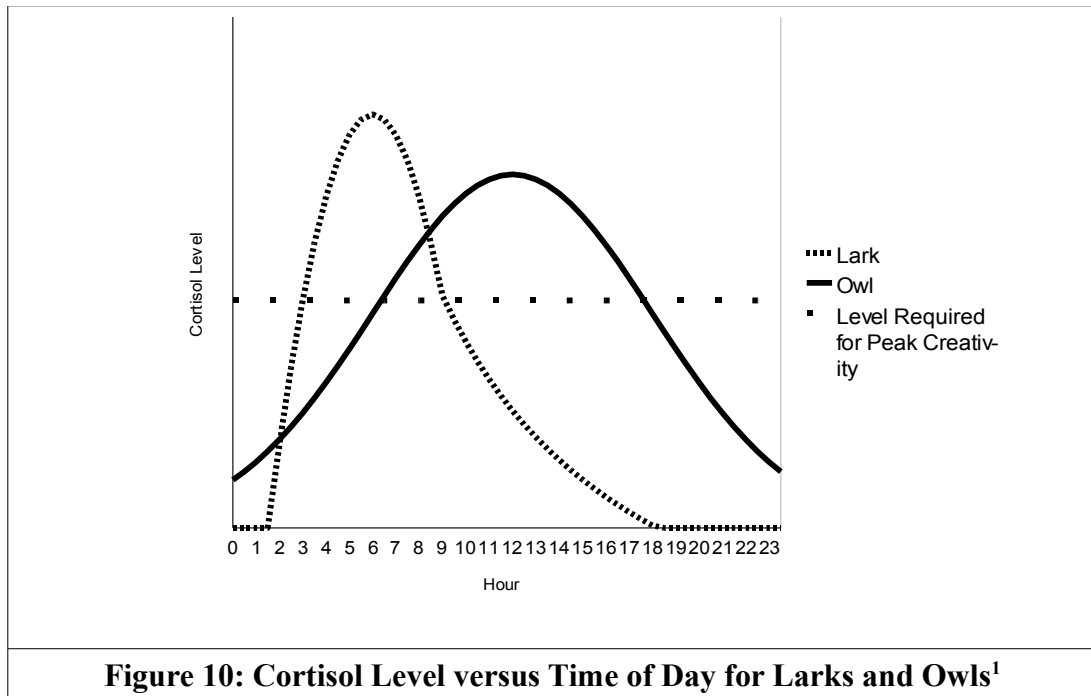
Figure 10: Cortisol Level versus Time of Day for Larks and Owls[1]

These cortisol pattern differences give rise to differences in the pattern of psychological arousal (Åkerstedt and Fröberg 1976) and even patterns of cognitive thought. Owls tend to think more in "right brain" patterns than larks, who are more likely to use "left brain" patterns (Fabbri, Antonietti, Giorgetti, Tonetti, and Natale 2007). Right brain thought is associated with creativity and holistic thinking, while left brain though is more associated with verbal and rational patterns. Owls do, in fact, seem to be more creative (Giampietro and Cavallera 2007) and intelligent (Cavallera and Giudici 2008), (Roberts and Kyllonen 1999).

There is some minimum level of arousal necessary for engaging in creative tasks

---

1 This figure is for illustrative purposes, rather than precisely to scale. While the actual curves are not so extreme, the general shapes hold. See Kudielka, Bellingrath, and Hellhammer 2007, Kudielka, Federenko, Hellhammer, and Wüst 2006, and Horne and Ostberg 1976 for more exact information on the curve shapes.

efficiently. Where exactly this level is will depend upon the nature of the task. In the case of IT programming, the level needs to be relatively high because it is a complex and demanding task, requiring that the IT worker keep many details in mind at the same time. Programming is a creative and holistic task, in which the IT worker builds a model of the desired processes, and implements a system which describes this model (Naur 1985). This causes a high cognitive load; in order for the IT worker to maintain this load effectively, her arousal needs to be fairly high. Since this is the main work task for an IT worker, they need to maintain this higher level of arousal for a long period of time-- ideally, for the entire work period. This means that effective IT workers need to have a broad cortisol peak. As can be seen from Figure 10, this is more likely true for owls than it is for larks. From this, we can expect that there will be a tendency for IT workers to be owls rather than larks.

On the other hand, managers are not generally under such a requirement. While their work will require some measure of creativity at times, usually these times are fairly short and require less detail be maintained. This is because managers spend much of their time working on relationship issues between themselves, their peers and superiors, and their subordinates. Each individual relationship does not require the same level of attention to detail and sustained creativity as programming does, and thus each can be accomplished with a lower cognitive load, and, hence, lower arousal levels. This would, in fact, be generally true of most other workers as well. While many jobs require creativity (such as marketing or graphic design) or attention to large numbers of details (such as accounting), very few require both simultaneously, for extended periods of time. Thus, managers will benefit less from being owls than IT workers would. This tendency will lead to managers being less likely to be owls than IT workers are.

The result of this analysis is that general managers are likely to be closer to the morning end of the chronotype scale, and that IT workers will have a chronotype that is shifted more toward the evening end of the chronotype scale.

H1: IT workers will have a chronotype closer to the evening end of the spectrum than managers.

The Effect of Worker Type on Chronicity

When deep within a coding task, IT workers enter a state of "flow" (Csikszentmihalyi and LeFevre 1989) in which their awareness focuses on a single task. While in this state of flow, the IT worker is less aware of the passage of time and of outside stimuli. Because the IT worker is focused fully on the task at hand, all their cognitive abilities are brought to bear on the programming task (Lakhani and Wolf 2003). This state is similar to that felt by a writer immersed in the production of a novel, or a scientist exploring the idea surrounding a new theory. This last is not a coincidence. Peter Naur argues that the act of programming is a type of theory development (Naur 1985). Thus, the kind of immersion and single-mindedness that helps creation of scientific theory also helps in the act of programming.

This experience of flow permits the IT worker to write code more quickly and with fewer errors than when they are not so singularly focused. External stimuli can break this focus, resulting in loss of flow, and thus loss of productivity for the IT worker. Thus, the ability of a IT worker to shut out external stimuli will improve their performance. Achieving this state requires that the IT worker focus on the task at hand, and on no other task. This kind of focus is known as monochronicity (Kaufman-Scarborough and Lindquist 1999). People who are more monochronic are likely to make better IT workers than people who are polychronic, and be more attracted to

programming as a profession. The action of the attraction / selection / attrition (De Cooman et al. 2009), (Schneider et al. 1995) will support this characteristic in IT workers who stay in the field.

Ondine, a typical IT worker, might work in long runs of programming, only breaking briefly, if at all, for meals. Often programming sessions can run overnight, and can even last several days or weeks with few short breaks. During this time, Ondine won't see many people, and will, in fact, be irritated if she is interrupted. This sometimes upsets her boss, Larry, who can't understand why she can't stop for a few minutes in the morning to let him know what she's working on, and why she won't make it to the status meeting in the afternoon. He is surprised when she reacts poorly when he suggests working on a different project at the same time.

On the other hand, managers tend to have many tasks under way at once. They are constantly interrupting one task to work on another. They often try to deal with multiple tasks at the same time. The "working lunch" is an example of this; rather than focus on their meal, the manager will instead perform other business simultaneously with eating. This behavior is known as polychronicity (Kaufman-Scarborough and Lindquist 1999). A person who is more polychronic is likely to be more successful as a manager than a person who is monochronic.

Therefore, managers are more likely to be polychronic than IT workers are.

H2: Managers will be more polychronic than IT workers.

The Effect of Worker Type on Time Urgency

The classic "type A personality" who succeeds as a manager has an acute sense for deadlines. The manager who can set and meet deadlines consistently is celebrated for her predictability and reliability. On the other hand, IT workers are fairly notorious for lax

consideration of deadlines. They will avoid committing to a deadline for as long as possible, and then will largely disregard it when it occurs. This can easily be seen by the commonplace slipping of schedules that happens on IT development projects; these slips are frequently direct causes of project failure. It is very easy to see, then, that IT workers are likely to be considerably lower in time urgency than managers are.

H3: Managers will be more time urgent than IT workers.

From Temporal Characteristics to Temporal Congruity

The simplest way to consider differences in temporal characteristics is to compare them individually. This is what has generally been done in the past (e.g., (Bluedorn and Denhardt 1988; Slocombe and Bluedorn 1999). However, most of these studies have considered only one temporal characteristic in isolation. When two or more characteristics are involved, the picture grows more complicated. If there is some correlation between the characteristics, then similarities in one characteristic could partially compensate for differences in another. On the other hand, the less correlation there is between the characteristics, the larger the combined effect of small differences may become. Both of these effects would be missed when comparing temporal characteristics individually.

We have looked previously at two different temporal characteristics, polychronicity and chronotype. These two characteristics are likely to be largely orthogonal. There is no reason to believe that the level of polychronicity a person has will have any correlation with whether they are an owl or a lark. Individually, either can cause a lack of temporal congruity. When Louise, a lark, has to work in the evening, her temporal congruity with respect to her chronotype will be low. That she is working on only one task that evening, which corresponds to her preferred

polychronicity, will not change the lack of congruity induced by the chronotype difference.

On the other hand, small differences in a particular characteristic may not be sufficient to cause a lack of congruity in and of itself. If Louise needs to work in the early afternoon, that will not cause a strong lack of congruity for her chronotype. Similarly, being in a meeting for an hour (interrupting her focus on programming) in the morning conflicts with her polychronicity, but because it is only for an hour, it may not cause enough reduction in congruity to be an issue. However, if she has to attend the one hour meeting in the afternoon, the two small differences in congruity may lead to a larger perception of incongruity.

This can most readily be seen by visualizing polychronicity and chronotype as axes for a scatter plot; see Figure 11 for an example. In this example, Louise's preferred temporal characteristics are labelled by an L. The requirements for the tasks she is performing are labelled C, P, and B for tasks which differ in chronotype, polychronicity, and both chronotype and polychronicity. It can be seen fairly simply that the Euclidean distance between her preferred temporal characteristics and tasks C and P is less than the distance between them and B. While the distance to C or P may not be significant, it is possible that the distance to B will be.

This is why we must consider temporal structures (Orlikowski and Yates 2002) when determining temporal congruity. Congruity on a single temporal characteristic may not be sufficient to prevent a significant lack of congruity overall. Nor may lack of congruity on a single temporal characteristic cause a significant lack of congruity overall. Note that comparing them this way also allows for the possibility that differences in individual characteristics are not necessarily additive, either, since the distance between Louise's preference and task B's requirement is 1.4 units rather than 2. The picture may be more complicated than the simple

Euclidean distance in a two-axis plane we present here. However, understanding that we need to consider the temporal characteristics simultaneously in some fashion by using temporal structures allows for a level of complexity not present when comparing characteristics individually.
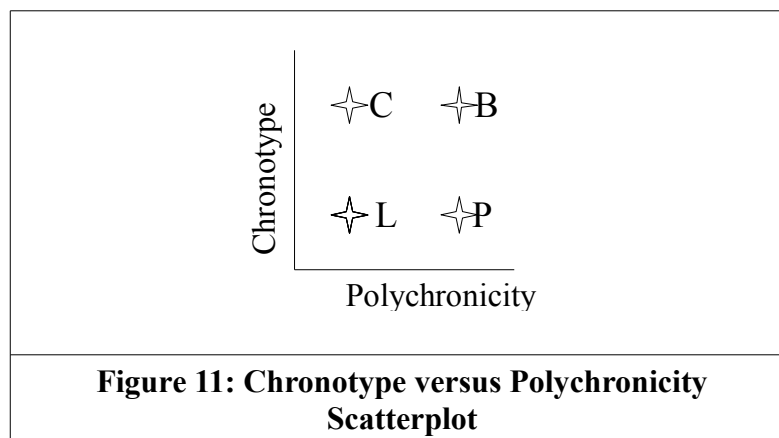
Figure 11: Chronotype versus Polychronicity Scatterplot

Because the temporal characteristics we are using are likely to be close to orthogonal, differences present in the characteristics used to create the temporal structure will be preserved in the temporal structures, and will thus manifest when we compare temporal structures. For this reason, differences in the temporal characteristics will cause, through the temporal structures, differences in the temporal congruity. Since we previously suggested that IT workers and managers have a specific pattern of differences in their individual temporal characteristics, these differences should carry through in the comparison between the temporal structures they have created. The previous discussion indicated that IT workers should differ from managers in chronicity, time urgency, and chronotype. Thus, IT workers should have temporal structures that significantly differ from their manager. Managers, however, work for higher-level managers;

there is no reason to expect serious differences between the way that front line managers and mid-level managers use time, since the job requirements are similar. Thus, a manager's temporal structures should be quite similar to that of the other people that they work with. We would, therefore, expect that the manager will experience greater temporal congruity than the IT worker.

H4: Managers will experience higher temporal congruity than IT workers.

The Effect of Worker Type on Temporal Dissonance

We have seen previously that there is a difference in the temporal congruity between IT workers and general managers. As noted with hypothesis 4, there is a tendency for the temporal congruity to be higher in managers than for IT workers. From our models in objectives 1 and 2, we know that a salient difference in temporal congruity leads to temporal dissonance. Thus, we expect that the difference in temporal congruity between managers and IT workers will lead to a difference in the temporal dissonance that IT workers and managers will feel, all else being equal, with the IT workers experiencing greater temporal dissonance due to their lower temporal congruity.

H5: IT workers' levels of temporal dissonance will be higher than manager's level of temporal dissonance.

Method

As noted above, we used the sample captured for objective 2 to examine objective 3. The measures used for the temporal characteristics are summarized in Table 8.

Table 8: Measures Used for Objective 3	
Construct	Source
Chronicity	Lindquist and Kaufman-Scarborough 2007
Chronotype	Horne and Ostberg 1976
Salience	As defined by Objective 1
Temporal Congruity	As defined by Objective 1
Temporal Dissonance	As defined by Objective 1
Time Urgency	Conte et al. 1995
IS Experience	Regardless of whether you are currently employed or not, how many years total have you been employed as an Information Systems Professional in all such jobs you have held?
Experience	Regardless of whether you are currently employed or not, how many years total have you been employed in all jobs you have held?
Manager	Have you ever managed any group of workers, whether they were IS professionals or not?

The data for this objective were collected at the same time as the data for Objective 2, from the same respondents. The measures added for this objective were established measures of chronotype (Horne and Ostberg 1976), chronicity (Lindquist and Kaufman-Scarborough 2007), and time urgency (Conte et al. 1995). We also added items to determine IS experience and managerial experience. To separate the two groups, we designated as IS workers those respondents who self-identified as an IT worker for most or all of their career (IS experience / total experience > 0.5), and reported never having been a manager. We designated as managers those respondents who self-identified as having worked as a manager, and as not having spent much of their career as an IT worker. IT workers were not paired with their own manager; this is a random sample of some IT workers, and some (likely unrelated) managers. The final sample for the comparison of means contained 156 IT workers and 138 managers. We compared the

means using 1-tailed t-tests with 293 degrees of freedom, since our hypotheses are directional.

Results

We performed a confirmatory factor analysis on the variables using SmartPLS (Ringle et al. 2005) to ensure construct validity. Tables 9 and 10 report the reliability and correlations for the measures. The results corroborated the results from objective 1 for the dissonance measures. The items loaded well on their construct, and did not significantly cross-load. Again, for space reasons we do not include measures which were used unchanged. The results for those measures were also sufficient for discriminant and convergent validity to hold.

Table 9: Reliability and Convergent Validity			
Variable	Composite Reliability	Cronbach's α	AVE
Temporal Congruity	0.845	0.757	0.580
Salience of Temporal Congruity	0.767	0.421	0.626
Temporal Dissonance	0.925	0.908	0.578

Table 10: Correlations				
Diagonal is $\sqrt{AVE}$	Temporal Congruity	Salience	Temporal Dissonance	Stress
Temporal Congruity	0.761			
Salience of Temporal Congruity	0.514	0.791		
Temporal Dissonance	0.742	0.556	0.760	
Stress	0.398	0.268	0.528	0.724

Table 11: Objective 3 Mean Comparisons					
Hypothesis	Mean Values		t (p-value)	Hypothesis Supported?	Meaning
	IT Worker	Manager			
H1 (chronotype)	3.61	3.69	-1.74 (0.042)	Yes	IT workers are more evening types than managers are
H2 (chronicity)	3.34	3.23	1.26 (ns)	No	No difference in chronicity between managers and IT workers
H3 (time urgency)	3.13	2.93	2.21 (0.014)	Yes	Managers are more time urgent than IT workers
H4 (temporal congruity)	3.21	3.09	1.53 (ns)	No	No difference in temporal congruity between managers and IT workers
H5 (temporal dissonance)	2.86	2.67	2.04 (0.021)	Yes	IT workers feel more temporal dissonance than managers

Discussion

Hypothesis 1 and hypothesis 3, holding that chronotype (lark/owl) and time urgency would be different for IT workers and managers, were supported. IT workers are likelier to be owls than managers are, and IT workers are likely to have lower time urgency than managers. H2 was not supported; we could not detect a difference in the chronicity preferences of IT workers and managers. H4 held that temporal congruity would be higher for managers than for IT workers. This hypothesis was not supported. On retrospection, we realized that it was likely that we had incorrectly theorized the relationship, and, in fact, it proved our point that congruence alone is not sufficient to explain past results. The temporal congruity for an IT worker and a manager should mirror each other; in other words, they should be the same. However, for the IT worker, any difference in temporal congruity is likelier to be salient than it would be for the manager. Managers have more power in the relationship, and thus are less concerned with the

differences than IT workers are. Thus, if I am a manager, the congruity is unimportant-- I can force my subordinates to work with time the way I do. As an IT worker, though, I do have to be aware of, and work with, my manager's temporal structure. Thus, there should be a difference in salience between the IS worker and the manager; the salience should be higher for the worker than for the manager. A post hoc test of the salience in study 2 did confirmed that IT workers did perceive the salience to be higher (means: 3.38 versus 3.13), with a t-statistic of 3.09 (p<0.01). Finally, Hypothesis 5, that IT workers would perceive higher temporal dissonance was supported. Because of our findings from Objective 2, this means that IT workers will suffer from increased stress and cynicism compared to their managers.

Objective 4

There are three notable weaknesses with our work so far. First, while increased stress and cynicism can be expected to cause difficulties with project completion, it can be argued that they are somewhat removed from actually affecting a project. It would be clearer if we knew that people who suffered these problems or temporal dissonance were indeed likelier to be part of a failed project through finding an increase in behavior directly related to project performance. Second, our two previous samples, due to the low incentive and unrestricted takers, tended to be primarily from India and China. It might be that our results reflect the culture of the respondents and the nature of IT work in India and China, which includes outsourced work which might be a confound. Third, the Cronbach alpha for the salience measure is weak, even though the composite reliability is good. We take this opportunity to strengthen these three areas.

Model

We extend the model from Objective 2 for this objective, by adding an additional

construct as the dependent variable, willingness to meet project deadlines. The model is

summarized in Figure 12. Hypothesis 1 and 2 from Objective 2 will be tested, as Hypothesis 1

and 2. Because the impact on cynicism was so small, we dropped it from this objective. We will

also recheck hypotheses 1, 3, and 5 from Objective 3, renumbered as hypotheses 5, 6, and 7 here.

We do not include hypotheses 2 or 4 from Objective 3, as they were not supported. We will add

confirmation of the difference in salience found in the post hoc analysis of Objective 3 as

hypothesis 8.

Figure 12: Model Summary for Objective 4:
Connect the Model to Willingness to Meet Project Deadlines
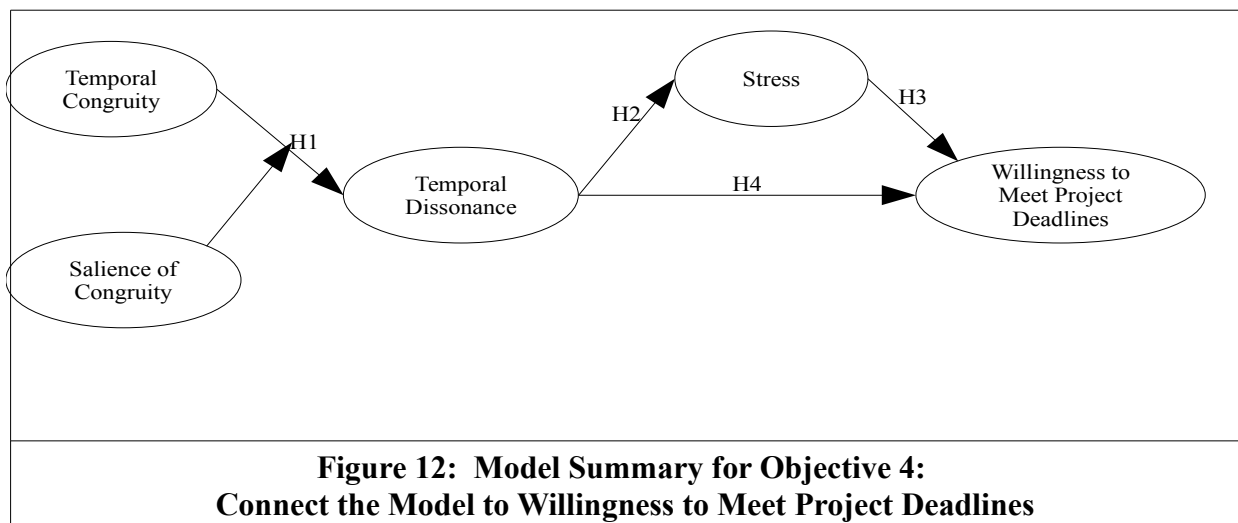
Justification of H1 and H2 are identical to the development for H1 and H2 of Objective 2.

H1: Temporal congruity and salience interact to create temporal dissonance; temporal

dissonance will be highest when temporal congruity is low and salience is high.

H2: An increase in temporal dissonance in an individual increases the stress felt by the

individual.

Justification of H5 through H7 are identical to the development for H1, H3, and H5 from Objective 3.

H5: IT workers will have a chronotype closer to the evening end of the spectrum than managers.

H6: Managers will be more time urgent than IT workers.

H7: IT workers' levels of temporal dissonance will be higher than managers' level of temporal dissonance.

The Effect of Stress on Willingness to Meet Project Deadlines

When a person is suffering from stress, their cognitive reserves are reduced. They do not feel that they are in control of their lives, and therefore they are unable and unwilling to meet obligations or do more than, at best, the least possible required for their job. While they would not necessarily object to meeting deadlines, neither are they willing or able to strive to meet those deadlines. Because of this, we expect that an increase in stress will lead to a decrease in willingness to meet project deadlines.

H3: An increase in stress decreases willingness to meet project deadlines.

The Effect of Temporal Dissonance on Willingness to Meet Project Deadlines

The individual suffering from temporal dissonance has competing salient temporal structures calling for their attention. The project deadline is one of the characteristics in their temporal structures. To the extent that the individual has not reduced their temporal dissonance yet, it may indicate that their personal temporal structures, or those of their family or other group, may be competing with the project for primacy. In order to reduce the discomfort felt with

temporal dissonance, the individual may engage in dissonance reduction behaviors, such as discounting the importance of the project deadline, or deciding that other temporal demands are much more important. Because of this, we expect that individuals with increased temporal dissonance will likely have a reduced willingness to meet project deadlines, unmediated by stress or cynicism.

H4: An increase in temporal dissonance will lead to a decrease in willingness to meet project deadlines.

Finally, as we argued before, the temporal structures of a manager are salient to the manager's subordinates. Conversely, the temporal structures of her subordinates are not inherently salient to the manager (though we hope that this work will help remedy that situation). As a result, managers are likely to feel less salience concerning temporal congruity than IT workers are.

H8: IT workers will experience higher salience of temporal congruity than managers.

Method

First, we added four items to the instrument to measure "willingness to meet deadline", which is the willingness to expend effort to meet a deadline regardless of the value the individual places on the deadline. These items were adapted from the measure of "willingness to exert effort on behalf of the organization" (Slocombe and Bluedorn 1999). Also, to address the weakness in the salience measure, we generated two new items for that construct. The new items are listed in Table 12.

Table 12: Items and Construct Added		
Construct	Tag	Item
Salience of Temporal Congruity	sal3	It is important for me to use time the same way my coworkers do
	sal4	It is important for me to be on the same schedule as my coworkers
Willingness to Meet Deadline	wdead00	I am willing to exert considerable effort to meet team deadlines
	wdead01	I will do extra work to meet team deadlines
	wdead02	I will work hard to meet team deadlines
	wdead03	I will do everything necessary to help my team meet its deadlines

Because we were interested in ensuring that time urgency is a separate concept from willingness to meet deadline and because it seems likely that there would likely be a correlation between time urgency and willingness to meet deadline, we included it in the survey.

We collected another Mechanical Turk sample for this objective; however, we made adjustments to the solicitation to change the nature of our respondents. First, the respondents were restricted to be from the US only, and the payment was increased to $1.00 per respondent to make the survey more attractive to US members. After deletion of responses which failed the check questions or were multivariate normal outliers, our sample size was 235.

Results

We performed a confirmatory factor analysis using SmartPLS (Ringle et al. 2005) on the variables to ensure construct validity. Tables 8 and 9 report the reliability and correlations for the measures. The results corroborated the results from study 1 for the dissonance measures. The items loaded well on their construct, and did not significantly cross-load. Because time urgency is a second-order construct, and because we considered its individual dimensions to be more likely confounds than the combined construct, we included the five subdimensions of time

urgency each as predictors for willingness to meet deadline. Modeling time urgency as a second-order formative construct did not appreciable change the results. Because we had added two new salience items, we also dropped sal01 prior to analysis as it had been rather weak in previous analyses, but we did not wish to reduce salience to a single item. With the introduction of the two new items, we judged it acceptable to drop the weak item, and then perform the analysis. The resulting construct was much better specified. As before, we present the statistics for reliability, convergent, and discriminant validity in tables 13 and 14. Once again, most values for the measures meet established guidelines for validity. The sole exception is that the Cronbach's αs for awareness of time and scheduling are slightly below the threshold of 0.7; however, the composite reliability is adequate, and, since these are well established measures and the AVE for both is quite good, we consider the reliability to be acceptable.

Table 13: Reliability and Convergent Validity				
Variable		Composite Reliability	Cronbach's α	AVE
Temporal Congruity		0.870	0.802	0.627
Salience of Temporal Congruity		0.806	0.714	0.586
Temporal Dissonance		0.938	0.925	0.628
Stress		0.877	0.841	0.536
Time Urgency	Awareness of Time	0.865	0.689	0.762
	Scheduling	0.827	0.625	0.709
	List Making	0.874	0.821	0.779
	Deadline Control	0.955	0.909	0.914
	Eating Behaviors	0.893	0.782	0.808
Willingness to Meet Deadline		0.944	0.921	0.809

Table 14: Correlations										
Diagonal is $\sqrt{AVE}$	1	2	3	4	5	6	7	8	9	10
1 Temporal Congruity	0.79									
2 Salience	0.45	0.77								
3 Temporal Dissonance	0.70	0.51	0.79							
4 Stress	0.35	0.35	0.54	0.73						
5 Awareness of Time	0.08	0.06	0.06	0.04	0.87					
6 Scheduling	0.21	0.14	0.21	0.07	0.16	0.96				
7 List Making	-0.12	-0.14	-0.03	-0.05	0.13	0.09	0.90			
8 Deadline Control	0.09	0.21	0.09	0.09	0.21	0.19	-0.11	0.88		
9 Eating Behaviors	0.17	0.14	0.31	0.30	0.12	0.29	0.10	0.10	0.90	
10 Willingness to Meet Deadlines	-0.16	-0.11	-0.32	-0.02	-0.38	-0.45	-0.09	0.35	0.15	0.84

Table 15 presents the results of the 1-tailed t-tests of the difference of means for hypotheses H5-H8. All the hypotheses were supported. Figure 13 shows the path model used to evaluate hypotheses H1-H4. All the proposed paths were significant, supporting all four hypotheses. We do not include main effects coefficients, as we did not hypothesize main effects. However, for completeness, the main effects coefficients were 0.238 for congruity and -0.214 for salience.

Hypothesis	Mean Values		t (p-value)	Hypothesis Supported?	Meaning
	IT Worker	Manager			
H5 (chronotype)	2.48	2.72	-2.06 (0.021)	Yes	IT workers are more evening types than managers are
H6 (time urgency)	3.18	2.89	2.00(0.024)	Yes	Managers are more time urgent than IT workers
H7 (temporal dissonance)	2.74	2.46	2.04 (0.049)	Yes	IT workers feel more temporal dissonance than managers
H8 (salience)	3.20	2.89	2.36 (0.011)	Yes	IT workers feel temporal differences are more salient than managers

Table 15: Objective 4 Mean Comparisons
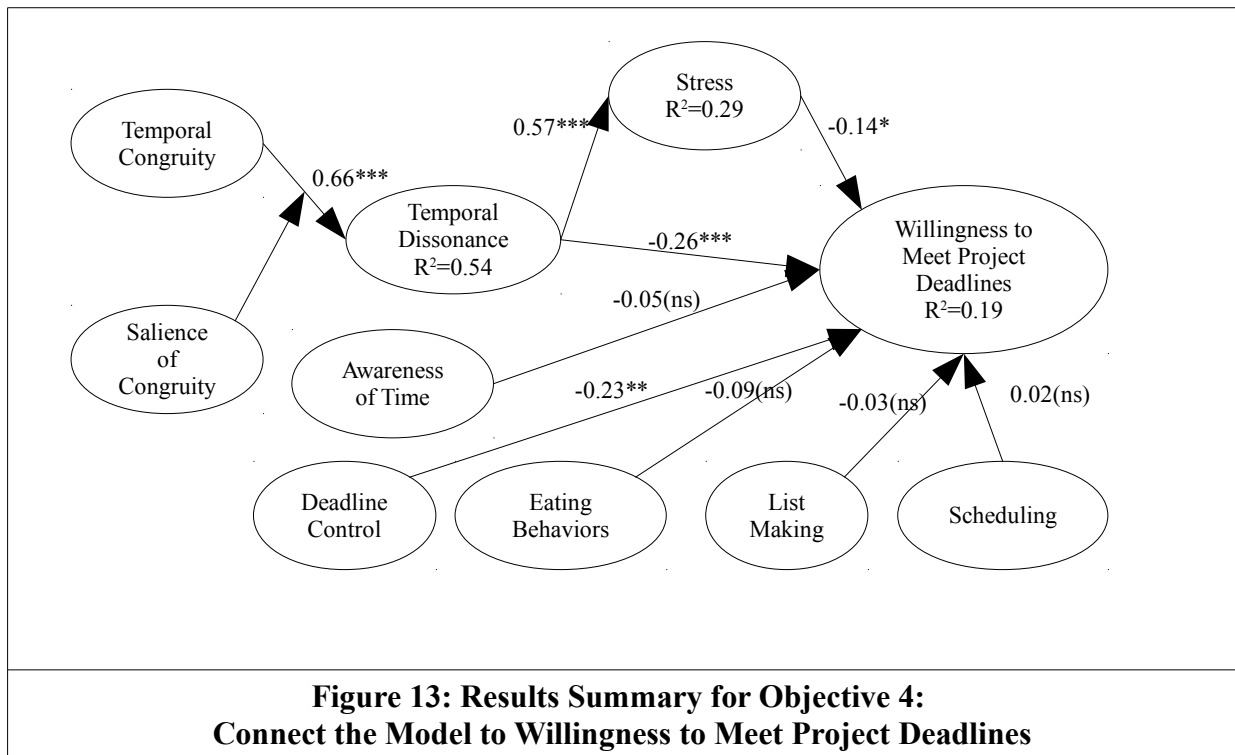
**Figure 13: Results Summary for Objective 4:
Connect the Model to Willingness to Meet Project Deadlines**

Discussion

Objective 4 is to address three weaknesses identified in our model that could be covered using a survey method. By ensuring that the survey takers were from the US, we were able to show that the results were not due to potential confounds such as cultural differences, outsourced work, or similar issues. The weakness in the salience measure was corrected successfully. Finally, by showing that increased temporal dissonance led to a decrease in willingness to meet deadlines, we have shown both that willingness to meet deadlines is a different construct from both time urgency and temporal dissonance, and that an attitude that can directly increase the likelihood of failure can be affected by temporal dissonance, both directly and via stress. One small note of interest is the sign on the "deadline control" component of time urgency. An increase in perceived deadline control-- that is, that deadlines can be managed by the respondent-- led to a decrease in willingness to meet deadlines; similarly, when modeled as a second-order formative factor, time urgency reduced willingness to meet deadline. This might be due to two possible explanations. First, if I have control over deadlines, I might conceivably be able to change them to suit my working speed. If I know I can change the deadlines, my willingness to put in extra effort to meet them may be reduced. Second, if I am naturally very aware of deadlines, then I may be generally more prepared for them, and not feel a need to expend extra effort to meet them beyond my normal level of effort. This could be an interesting phenomenon to examine in the future.

Overall Discussion

The purpose of Objective 1 was to develop the new measure needed for temporal dissonance, by checking how the factor analysis came out and eliminating problematic items. A

limited number of items for the supporting constructs were generated, as they were not the focus of the study, while many items were generated for the temporal dissonance measure. However, it turned out that the dissonance measure was very clean, and the items that needed to be dropped came from the supporting constructs of temporal congruity and salience. With only two items for salience remaining, and one of those weak, we needed to strengthen the salience measure. Temporal congruity still retained four items, so is an adequate measure. It is likely that items could be dropped from the temporal dissonance measure itself, although there was no strong reason to do so in this work.

Objective 2 confirmed the results of Objective 1, and expanded focus to the consequences of temporal dissonance. The results supported the theory that temporal dissonance is generated from an interaction of temporal congruity and salience, and that it results in increased stress and cynicism. The connection between temporal dissonance and cynicism, while significant, is not very useful from a predictive standpoint, as it only explained 4% of the variance in cynicism. The connection between temporal dissonance and stress was more robust, explaining between 28% and 32% of the variance in stress.

Objective 3 provided general support for the idea that managers and IT workers use time differently. IT workers are more likely to be more like owls than managers are, and they are less concerned with deadlines. However, contrary to expectation, they apparently do not differ in chronicity. A possible explanation for this is that recent studies have shown that a preference for polychronicity correlates with less ability to multitask in reality (Ophir, Nass, and Wagner 2009). Since what matters for a manager is actual performance rather than simple preference, it seems likely that the ability to multitask would vary between IS workers and managers, but the

preference may not be different.

Objective 4 lent further credence to the original hypotheses which were upheld. This study also provided sufficient salience items to get a good measure for salience. This study also found that, in American workers and in people who were more verifiably IS workers, the hypotheses held. Finally, we were able to show that temporal dissonance, and the stress and cynicism it generates, contributes to project failure directly, by reducing IT workers' willingness to meet project deadlines. This willingness may represent a dissonance reduction mode in which the IS worker reinforces the need to comply with their manager's (or organization's) temporal structure concerning deadline, subsuming their own preference. The result is that the worker's sense of time urgency would be suppressed, reducing the felt temporal dissonance.

Limitations

As with any work, this study has limitations. It is possible that the use of the Mechanical Turk did not result in selection of subjects that were both random enough and motivated enough to take the survey seriously. The inclusion of some student respondents in Objective 1 and a professional set of respondents for Objective 4 help alleviate this limitation somewhat; however, repetition with different groups would strengthen the validity of the measure. Also, we only investigated a small portion of the nomological net. There may be other outcomes strongly associated with temporal dissonance, and other antecedents which have particular importance to IT workers. Finally, conclusions about causality should be considered with caution, as other models with differing causality will fit the data as well as the proposed model. Cross-sectional studies cannot prove causal relationships (Stone-Romero and Rosopa 2008).

Implications for Practice

The increased cynicism and stress resulting from the increased temporal dissonance felt will reduce the performance of IT workers in general. However, it should be noted again that, while the path was significant from temporal dissonance to cynicism, the R^2 was quite small. In practical terms, the contribution of temporal dissonance to cynicism is probably not large. However, the effect size on stress was considerably larger, and is certainly of practical interest. Since many IT projects fail because of undermined motivation and poor working relationships among team members (Nelson 2007), increases in stress and cynicism due to temporal dissonance, as well as temporal dissonance itself, may well contribute to some of those failures through a reduction of IT workers' willingness to meet project deadlines. Since management should be trying to reduce stress and cynicism in order to improve performance, this research indicates one route that can be taken. Management should try to reduce their focus on specific ways of interacting with time, such as deadlines or working hours when dealing with IT workers. Allowing the IT worker to work at their preferred time would reduce the perceived temporal incongruity, while de-emphasizing deadlines would reduce the salience of differences in time urgency. Alternatively, the manager could try to improve deadline performance by directly encouraging the willingness to meet deadline. By reducing these antecedents, management should be able to reduce the felt stress and cynicism, which should improve performance of their teams and reduce the chance of project failure.

Implications for Research

From a scientific standpoint, we have provided an empirical validation of the existence of temporal dissonance. We have explained how it provides a first step in showing how temporal

characteristics and temporal congruity affect individual performance. Our model also provides a new frame for understanding why some IT projects fail.

This work has created a new way to examine how IT workers and management interact, by using a framework of time as a lens. This framework combines insights from the social psychology of time, chronobiology, and cognitive dissonance to the dialogue concerning the challenge of working with IT workers. It is very likely that this framework would be useful in other areas of IS research. For instance, trust would seem to be an obvious candidate for being affected by temporal dissonance. In fact, trust might well be much more sensitive to temporal dissonance, and explain more fully, interpersonal problems in teams than cynicism does.

Understanding how temporal dissonance comes about allows us to examine time management with a new eye. Many time management systems promote use of lists, prioritization, and ticklers to reinforce deadlines and focus on timelines. These mechanisms clearly provide specific ways of structuring time. For the individual with a lack of congruity in the particular characteristics being manipulated by the time management system, these techniques can serve as a method to drive their personal temporal structures to more closely resemble external temporal structures. This has the effect of increasing temporal congruity, and thus reducing temporal dissonance, stress, and cynicism, if the characteristics being modified are also salient. However, if the individual already has high temporal congruity in the characteristics being manipulated, or the characteristics are not salient in the particular work situation, then these techniques will not be effective at improving performance. In fact, in the case where the salience is high and the individual already had high temporal congruity in those characteristics, the time management system may even reduce performance. To be effective, the individual must

understand what characteristics are both salient and incongruent, and then they can tailor time management tasks to those characteristics.

This work has focused on the individual level. Team processes are also subject to issues of time, and likely this framework could provide new insights into team cognition. Additionally, there are likely to be cross-level effects which may help to explain some of the contradictory results found in the past on the efficacy of time management techniques.

As seen in the Rowe and Struck work, the temporal characteristics of the IT artifact may also come into play as a source for temporal dissonance, as evidenced by the precursor of reactivity, which is very similar to temporal congruity (Rowe and Struck 1999). That work would suggest that the nature of the artifact, the role being occupied by the individuals involved, and the nature of the project itself will all contribute characteristics that may have temporal components, and could provide a rich field for further study. For instance, highly innovative work may require more frequent communications in order to properly build the theory that the implementation team is performing, and thus synchronicity of time between developers and users may become a salient temporal characteristic. This might even have some bearing on the use of user involvement in agile practices.

Conclusion

We have shown that our proposed scale for individual temporal dissonance has good psychometric properties. We have been able to differentiate it from similar constructs such as temporal congruity and stress, and have been able to demonstrate that it fits into the nomological network as hypothesized. Using this measure, we have shown how IT workers systematically

vary from managers, resulting in increased temporal dissonance in the IT worker. This increased

temporal dissonance results in increased stress, cynicism, and reduced willingness to meet

project deadlines in the IT worker.

Essay 3: Temporal Transitions in Teams: The Case for Temporal Dissonance

Abstract

Prior work has shown that team development can be disrupted by differences in temporal perceptions by team members. These disruptions result in performance problems for teams. We examine the literature and integrate theories of the group development process, cognitive dissonance, and temporal congruity; from this integration we develop the concept of team temporal dissonance. Team temporal dissonance is an affective reaction to salient differences in temporal structures between team members and/or temporal requirements from the team environment. From this theory, we are able to explain how and when entrainment can improve team outcomes. Additionally, knowledge of the mechanism will permit more rational selection of techniques to improve team performance through time management interventions.

Introduction

"When shall we three meet again?"

William Shakespeare, Macbeth, Act I. Scene 1 line 1

Business relies more than ever on teams for its work. However, many of those teams do not work as well as they could (Useem, 2006). The problem is so pervasive that the April 2012 issue of Harvard Business Review had three articles on the subject of teams. Each of these articles claimed to have the solution to making teams perform more effectively. Interestingly, the three articles presented three different solutions: an attendance to knowledge sharing to ensure that the team does not focus too much on shared information (Gardner, 2012); an attendance to patterns and modes of communication (Pentland, 2012); and care to utilize good project

management skills, flexibility, and making teams a safe place for team members (Edmondson, 2012). This last noted the business shift to "teaming" rather than "teamwork", in which teams are potentially distributed geographically, and must rapidly work together, without the time to cope with disagreements due to individual differences. These distributed teams-- teams in which the members communicate using one or more information technologies to complete specific organizational tasks (Powell, Piccoli, & Ives, 2004)-- make the problems even more complex. Team members may be located in many different countries and cultures. These teams offer business considerable potential advantages: access to the greatest expertise on the task at hand, round-the-clock work, rapid response times, and reductions in travel costs (Kankanhalli, Tan, & Wei, 2007). With these benefits, however, come some significant disadvantages. Even without the complications of virtuality, businesses still struggle to enable effective teams (Useem, 2006).When virtuality is added in, the situation gets worse. Gartner estimates that approximately 41 million employees will work on virtual teams (Useem, 2006). They also predict that "...50% of virtual teams will fail to meet either strategic or operational objectives due to the inability to manage distributed workforce implementation risks" (Biggs, 2000). If business is to harness the power of teams, whether distributed or co-located, it must learn how to make those teams more effective. One method that is commonly used is time management, since the management of time seems to be a perpetual concern in teams. "When is the next meeting?" is a question that seems to happen in every team meeting, either directly or implicitly. In theory, managing a team's time better should result in better productivity. However, a quick search on Amazon for "team time management" results in 1,727 books listed. A similar search on youtube indicated some 20,700 results. While it is certainly true that there are duplications and irrelevant items in both sets of

results, it is clear that there is no accepted answer to the question of how to improve team performance through time management. This is borne out by academic research which indicates mixed results for the efficacy of time management techniques on improving performance (Claessens, Eerde, Rutte, & Roe, 2007; Macan, 1994).

The diversity literature has shown that individual differences among team members creates a complicated picture for performance, with increased diversity helping performance in some circumstances, but harming performance under other circumstances (Jehn, Northcraft, & Neale, 1999; Kankanhalli et al., 2007; Lau & Murnighan, 2005; Pelled, Eisenhardt, & Xin, 1999). Most of this work has focused on demographic differences (race, age, sex, etc.) or larger cultural dimensions, such as Hofstede's power distance, uncertainty avoidance, individualism, etc. (Hofstede & Hofstede, 2004). One class of individual difference that has gotten some attention at the organizational and individual levels is temporal characteristics. When considering temporal characteristics, the focus has been upon congruence of temporal models. Suggestions for improving congruence include entrainment, training, and the like, with the expectation that this would improve organizational function. These works also examined the negative effects of a lack of congruence, including increased stress and reduced work-life balance (Bluedorn & Denhardt, 1988; Ryan, 2008; Standifer & Bluedorn, 2006). At the individual level, results suggest that individuals with time structures incongruent with those of their organization suffer stress, leading to health effects and poor performance (Cotte, Ratneshwar, & Mick, 2004; Kaufman, Lane, & Lindquist, 1991; Slocombe & Bluedorn, 1999). While these research streams make it clear that temporal issues are important at both the individual and organizational levels, little work has been done examining temporal effects at the team level. The few studies that have

been made tend to focus on one particular aspect of time (e.g. time dispersion (Maznevski &

Chudoba, 2000; O'Leary & Cummings, 2007; Sarker & Sahay, 2004). However, as we will show

below, people exhibit a number of different temporal characteristics, each of which are important

to that individual's interactions in the larger world. Further, there are many indications that time

is of critical importance to teamwork. Group development theories suggest that teams generate

an internal sense of time which patterns their interactions (Gersick, 1989; Tuckman & Jensen,

1977), and distributed teams which schedule regular periodic face-to-face meetings perform

better (Maznevski & Chudoba, 2000). This was underscored in work which, in part, replicated

Gersick's experimental study, but altered start clock times. The results were stunning: simply

shifting the start time by a few minutes had significant implications for team performance

(Labianca, Moon, & Watt, 2005). The main findings have suggested that congruence of temporal

characteristics among team members and the team's environment and entraining are needed for

teams to function well. However, the complex nature of time suggests that congruence is

unlikely to be a complete explanation of the temporal difficulties faced by teams. Nor, in fact, is

it easy to define "congruence," given the multidimensional aspects of time (Ancona, Okhuysen,

& Perlow, 2001; Saunders, 2007). Is someone who is past focused and time urgent more similar

to someone who is present focused and time urgent, or to someone who is past focused and not

time urgent? Further, none of this work examines the psychological or social mechanisms by

which this congruence operates. Congruence exists in an environmental context; in order for

congruence to have an effect on behavior, it must be perceived and reacted to, whether

consciously or not (Ajzen, 1985; Seo, Barrett, & Bartunek, 2004; Weiss & Cropanzano, 1996). In

order to understand how best to manage time, it is critical to understand the mechanism by which

the objective, external fact of temporal congruence is perceived and interacts with the emergent process of team cognition. Thus, our research question is: What is the mechanism by which temporal congruity affects team performance?

To address this gap, we develop a theory of team temporal dissonance, which extends the theory of temporal dissonance from the individual level. Temporal dissonance at the individual level is the discomfort felt when two or more salient temporal structures lack congruity (Conway & Limayem, 2010). When we consider the team level, we can see similar types of development to that seen in an individual. Teams develop emergent shared mental models of time, which can conflict with the demands of their environment and the characteristics of the team members. We present a definition of team temporal dissonance as the tension felt in a team which has demands on its use of time that differ from how the team would naturally use time.

It is interesting that, in discussing high-performing teams, Maznevski and Chudoba talk about a "rhythm of regular face to face meetings" being critical to virtual team success (Maznevski & Chudoba, 2000). Rhythm is an important aspect of music. When a musical piece juxtaposes multiple conflicting rhythms, tempos, and / or meter, a situation of "musical temporal dissonance" may occur. The result of musical temporal dissonance is a heightened tension in the listener, due to the difficulty of resolving conflicts in the rhythmic and metric patterns. It is similar to the tension caused by dissonant tones, although not necessarily as obvious. The listener is made uncomfortable by the dissonance, and wishes to hear the dissonance resolve into a consonance (Thomas, 2000). We will, through the course of this essay, develop a definition of team temporal dissonance with similar characteristics. As with musical temporal dissonance, temporal dissonance in teams requires an underlying lack of congruity in temporal

characteristics. However, as with music, temporal dissonance is not the same as a lack of congruity; lack of congruity is a necessary, but not sufficient, precondition. The actual state of temporal dissonance is the tension felt when a lack of congruity between team members' temporal characteristics and the team environment's temporal demands is made salient. The team suffers heightened tension due to an inability to resolve the rhythmic, metric, and temporal patterns implied by the differing temporal characteristics. This heightened tension is uncomfortable, and leads to attempts by the team to resolve the conflicts, or to decrease the importance of the conflicts; effectively, to return the team to temporal consonance. Temporal dissonance can be used to explain some failures in team development processes, as noted by Gersick and Labianca et al., and to explain why reinforcement of particular temporal modalities can help a team function more smoothly, as noted by Maznevski and Chudoba (Gersick, 1988, 1989; Labianca, Moon, & Watt, 2005; Maznevski & Chudoba, 2000).

To develop this theory, we will discuss types of temporal characteristics and briefly review several relevant streams of research in the section titled "Background". We will consider team mental models and social identity theory in order to justify a team's possession of temporal characteristics created from, but also distinct from, those of its members. Then, we will briefly review cognitive dissonance for an explanation of how conflicting characteristics can cause tension in the team. We will also very briefly note the theory of team dynamic conflict. After that, in the "Theory of Temporal Dissonance" section, we will provide a definition of temporal dissonance, and place it in the nomological net, generating several propositions for its operation in team processes. We will conclude with a section titled "Discussion", which will show how the theory of temporal dissonance can explain the odd effects in team processes noted by Gersick

and Labianca et al., and what implications this theory has for time management.

Background

In this section, we will explore briefly the background literature that we use as a basis for our theory of temporal dissonance.

Temporal Characteristics and Temporal Structures

There are many individual characteristics relating to time. These range from purely biologically based notions of time such as circadian rhythm (Horne, Brass, & Pettitt, 1980) to purely social concepts such as "banana time" (Ancona, Okhuysen, & Perlow, 2001; Roy, 1959). As with any other individual characteristic, a team can adopt these temporal characteristics as its own through social identity processes. For instance, if the majority of people on a team are larks, they are likely to prefer to meet in the morning. If allowed to meet whenever they want, the team as a whole is likely to adopt morning meetings as a shared value, and thus exhibit the characteristic of being a lark itself, socializing new team members to the morning meeting time. The large number of temporal characteristics makes dealing with time in any complete fashion difficult. To handle the temporal interaction between ourselves and our environment, we create internal temporal structures. These are schema that allow individuals to organize, consciously and unconsciously, interactions with and uses of time (Orlikowski & Yates, 2002). While single temporal characteristics, such as time urgency or chronicity, focus on a specific aspect of time, temporal structures collect all the temporal characteristics and create an emergent model of time. Thus, a temporal structure provides a way to interact with time based upon all time's aspects simultaneously. Just as for individual temporal characteristics, teams will develop their own

temporal structures. These temporal structures may conflict in ways that can cause stress, which is a key source of common concerns about work–life balance (Orlikowski & Yates, 2002) and its potential to harm individual health and performance (Bluedorn & Denhardt, 1988; Slocombe & Bluedorn, 1999). These individual temporal structures will be used by a team to create team temporal structures, likely through the social identity mechanisms we discuss next.

Social Identity

Teams develop their own unique characteristics, emergent states which derive from interactions among the team members. These characteristics eventually assume their own identity and weight. Once a characteristic has evolved, it becomes a part of the team identity, and is adopted by the team members in their concept of a prototypical team member (Ashforth & Mael, 1989). The prototypical team member defines for the individual the characteristics that they consider members of the team to have. These characteristics are maintained by the team members as part of their shared mental model of the team (Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000) and can even be adopted by members as characterizing themselves (Hogg & Terry, 2000) While these characteristics emerge from the traits of the team members, they attain an existence separate from the team members, due to the distributed nature of the characteristics. They are ascribed to the team by the models each team member maintains of the team; and are representative of the team to the degree that the models of the team members agree with each other (Mathieu et al., 2000).

Team characteristics result from the complex interplay of social identity theory mechanisms (Hogg, 2001). When they are members of a team, people tend to think of themselves as sharing characteristics with the team. They do this through anchoring (Ashforth &

Mael, 1989) and self-categorization (Hogg & Terry, 2000). In anchoring, individuals ascribe

characteristics to the team based upon their personal characteristics. For instance: "If I'm a

member of this group, then it must be like me. Since I'm an owl, members of this team are owls."

The reverse process, self-categorization, also happens: "Members of this team are larks.

Therefore, I must be a lark, since I'm a member of the team". If the individual held the

characteristic strongly before joining the team, the result is likely to be anchoring; if the team

had a strongly held characteristic before the individual joined, it is more likely that the individual

will self-categorize. When both identities are weak, there is little impetus to derive the

characteristic; and, when both identities are strong, the result is conflict (Hogg, 2001).

Team Shared Mental Models

Shared mental models concern a "shared, organized understanding and mental

representation of knowledge or beliefs relevant to key elements of the team's task environment"

(Kozlowski & Ilgen, 2006). They comprise both a set of declarative knowledge and a function

(Thomas, 2000). There are four types of team mental model, depending upon their function.

Each type organizes a set of information about the environment, and can be classified as being

about the technology, the task, the team interaction, or the team itself (Cannon-Bowers, Salas, &

Converse, 1993). Required knowledge about team interaction (or team social processes) tends to

be idiosyncratic to the team, e.g. team roles, communication channels, etc. Similarly, the meta-

level information about the team itself tends to consist of attitudes toward teamwork, goals, etc.

Knowledge in these areas is very likely to be included in team shared mental models. Knowledge

about the task and about the technology and tools, however, is likely to be more diverse, and

require more specialized knowledge. It may also be less critical that this information be shared

among all team members (Mathieu et al., 2000).

Team shared mental models have been consistently found to improve team performance. Increased sharing of information improved crew performance in non-routine situations (Waller, Gupta, & Giambatista, 2004). Crews with strong team mental models tended to work to improve their shared information during periods of high workload. This sharing of information can lead to implicit coordination, in which team members anticipate other team members' needs based upon the shared model (Rico, Sánchez-Manzanares, Gil, & Gibson, 2008). Communication latency due to asynchronicity can make shared models more important (Pavitt, 2003), a result which is likely to be particularly germane for distributed teams.

Cognitive Dissonance

When creating team temporal structures from individual team member structures, the actions taken include emphasizing certain time characteristics and downplaying others (Cotte et al., 2004). In organizations, people often force themselves to cope with competing temporal structures when they lack the power to alter them but will negotiate changes if they can (McGrath, 1991). These actions are highly reminiscent of coping behaviors used to reduce cognitive dissonance, which refers to the discomfort a person feels when he or she holds two conflicting attitudes (Festinger, 1957). To reduce this discomfort, people often reduce the salience of any beliefs that appear dissonant with the desired attitude; they add consonant beliefs to strengthen their desired attitude; or they attempt to change the dissonant beliefs to remove the dissonance (Aronson, 1969). Groups also suffer from cognitive dissonance, and reduce dissonance in fashions similar to those used by individuals, including salience reduction, modification of the environment, or modification of beliefs (Matz & Wood, 2005). In fact,

Festinger's original work that led to the conception of cognitive dissonance concerned doomsday cults, and how they dealt with failures of doomsday to appear on schedule (Festinger, Riecken, & Schnachter, 1956). While it is almost certainly true that the individuals in the cult experienced individual-level cognitive dissonance, it was felt independently at the group level as well.

Team Dynamic Conflict

The last piece that we need to understand team temporal dissonance and its effects is team dynamic conflict. Team dynamic conflict is the mechanism by which teams interact as they go about performing the work for which they were created. Teams engage in three types of conflict as they interact. These are process conflict, task conflict, and affect conflict. Process conflict is conflict within a group concerning resource allocation, decision processes, methods for handling group work, or any other type of task concerned with how the group goes about performing the actual task assigned (Jehn, 1997); conflict concerning how the team should structure time would be an example of process conflict. Task conflict is conflict concerning the solution to the task itself. For instance, a committee responsible for choosing a product mix undergoes task conflict when they discuss possible mixes and their pros and cons. Moderate levels of task conflict are beneficial to group function, as it allows the group to explore the possible solution space and pick optimal solutions. Too little task conflict results in group think, in which groups choose what has always been chosen, which may not be optimal. Too much task conflict can cause the group to be saddled with "analysis paralysis", failing to make decisions in a timely fashion (Jehn & Mannix, 2001). Affect conflict (also called relationship conflict) happens when there is a personal conflict between members of the group that is unrelated to the task and is social in nature. In a concrete example related to time, teams on which members

matched polychronicity better to the organization's professed polychronicity perceived that they were evaluated more highly, and had more commitment to the organization, indicating that mismatches could have resulted in affect conflict (Slocombe & Bluedorn, 1999). Both affect conflict and process conflict are detrimental to team performance, as they take time out from the actual task, and can drive decisions for reasons other than the task at hand. Affect conflict happens when team members are perceived to deviate from the team identity as established by the team's shared mental model, and process conflict happens as a result of conflicts about the utilization of time, among other possible sources.

Theory of Temporal Dissonance

We begin our discussion of team temporal dissonance with a model diagram, Figure 14, which presents how temporal dissonance fits into the nomological network at the team level. We will present the definition of several constructs, including temporal dissonance, and then discuss each element of the figure.
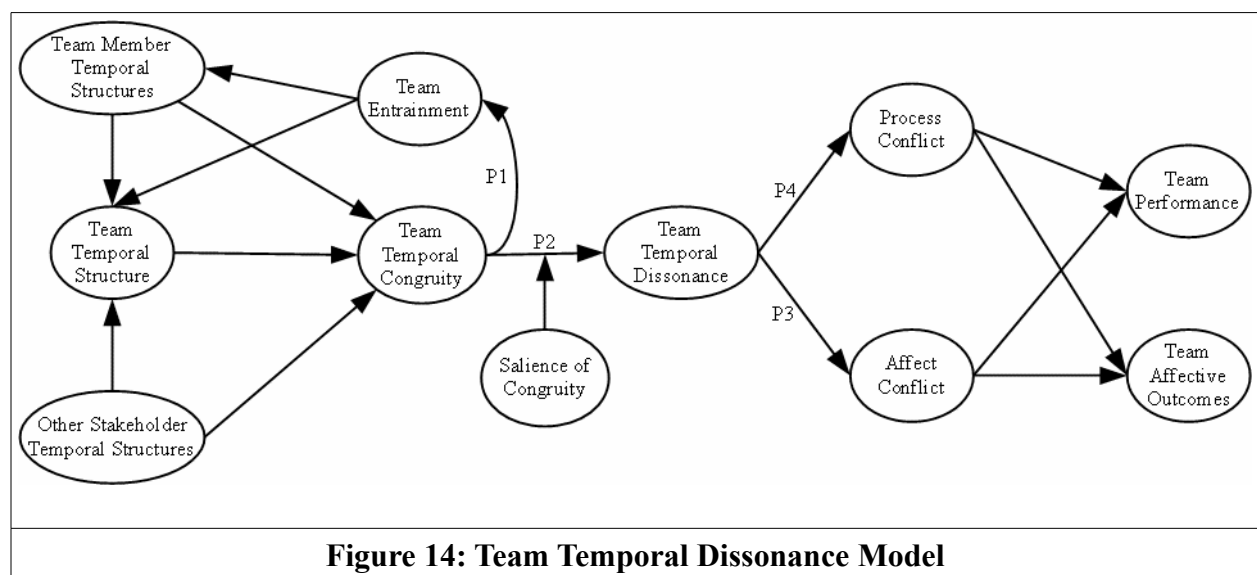
Figure 14: Team Temporal Dissonance Model

Construct Definitions

We now present a summary table of the constructs for the theory of temporal dissonance. Each will be discussed in more detail in the following sections; however, this will provide the context necessary to understand those discussions. A summary of the definitions is in Table 16.

Temporal Dissonance

Team temporal dissonance is the tension felt in a team when two or more salient team temporal structures and/or team member temporal structures lack congruity. Because the conflicting structures are salient, the team members know that they must have some value for the team temporal structure. Because team members have differing structures and differing perceptions of external structures, the anchoring and self-categorization features of social identity theory will not work as expected, resulting in a lack of consensus for the team temporal structure. This lack of consensus causes conflict as the team attempts to resolve the differences in order to generate a team temporal structure for use in structuring its use of, and interaction with, time.

Table 16: Construct Definitions for the Theory of Temporal Dissonance	
Team Temporal Dissonance	The tension felt in a team which has demands on its use of time that differ from how the team would naturally use time
Team Member Temporal Structures	The individual temporal structures of the members of the team.
Team Temporal Structure	A shared mental model which organizes and structures the team's use of time. It is a schema which contains the team's adopted values for temporal characteristics.
Other Stakeholder Temporal Structures	The temporal structures of other stakeholders in the team's environment which can affect the team's temporal structure, such as organizational temporal structures, partner temporal structures, or other teams' temporal structures.

Table 16: Construct Definitions for the Theory of Temporal Dissonance	
Team Temporal Congruity	The similarity of the team temporal structure with members' temporal structures and other stakeholders' temporal structures.
Team Entrainment	Processes which change team members' temporal structures and the team's temporal structure to increase the level of temporal congruity.
Salience of Congruity	The degree to which the elements of the temporal structure are important in the context of the team. The salience is also an element of the team's shared mental model.
Process Conflict	Conflict within a team concerning allocation of resources and team procedures.
Task Conflict	Conflict within a team regarding solutions to the task to which the team is set.
Affect Conflict	Conflict within a team at an individual relational level.
Team Performance	The productivity of the team at the task to which it is set.
Team Affective Outcomes	The emotional reactions of team members due to perceptions of the team context. Perceptions of performance, morale, and cohesion are examples of these outcomes.

Team Temporal Structure, Team Member Temporal Structures, and Stakeholder Temporal Structures

Team temporal structures are formed as shared mental models, incorporating characteristics from the team members themselves and from the surrounding environment. Any entity which is salient to the team may have temporal structures which must be incorporated into the team. For instance, a company which values multitasking may pressure its teams to prefer multitasking.

Teams, like individuals, carry their own individual characteristics. Once the team adopts a characteristic it takes on a life of its own, separate but not independent from that of the team members. We can see this in the way that, when new individuals join a team, their identity as a team member is shaped by the characteristics of the team through self-categorization, while at

the same time they shape the team to be more like themselves through anchoring. Other

characteristics come from the environment that the team finds itself in. For instance, in theater

companies, the primary mode of work is late at night. Teams working on a theater project will

tend to also work at night fairly automatically, even when it is unnecessary or awkward, e.g.

purchasing materiel for sets. The nature of the task can also help define a team's temporal

structures. For instance, IS developers tend to have a somewhat lower sense of time urgency

(Conway & Limayem, 2011), so a team of IS developers will generally tend to have a somewhat

lower sense of time urgency as a team temporal characteristic as well. However, a firefighting

(rapid bug fixing) team may well have a higher sense of time urgency as a team characteristic,

since team members know that rapid fixes may be critical to the success of a product or even a

company. There is a strong requirement that the team operate with high time urgency, and so the

team will adopt that as a temporal characteristic regardless of their own preferences. All these

temporal characteristics are organized into the team temporal structure.

Because the team temporal structure is an emergent state coming from multiple

influences, it is subject to constant revision and refinement. Changes in team members can shift

balances, and this can change individual characteristics. Changes in the team's environment can

also cause changes in the team's temporal structures. There is a fairly constant state of flux in the

temporal structures driven by these inputs.

Team Temporal Congruity

The team's temporal congruity is the similarity of the team's temporal structure to the

temporal structures of the environment and the team's individual members. Other environmental

temporal structures may include perceived temporal demands from the organization which

surrounds the team (such as working hours or reaction time), stakeholders of the team (such as other teams which supply a team, other teams that use the product of the team), and task demands (such as urgency or multitasking), The more uniform team members are in their individual temporal characteristics, the higher the team temporal congruity will be. Note that temporal congruity is simply a comparison between schemas; one way to measure it would be to simply compute the 2-norm of the vector implied by considering the individual temporal characteristics which make up the temporal structure in a multidimensional space.

Salience of Congruity

The salience of temporal congruity is a measure of how important temporal congruity is to the team. Salience may vary based upon individual characteristics. For instance, organizational working hour requirements may make chronotype salient, but will probably not make chronicity salient. Individual team member temporal structures will generally be salient for a team, simply because as team members they are important to the team.

Entrainment

In teams which have some level of incongruity in temporal structures, team entrainment can be used to increase temporal congruity. This is the source of the improvement noted in teams which meet regularly (Maznevski & Chudoba, 2000). Because the opportunity for the social interaction that allows synchronization of temporal structures is lower for distributed teams than it is for co-located teams, this kind of entrainment is likely to be much more important.

Proposition 6: Teams with low temporal congruity can use entrainment to change their temporal structures to increase temporal congruity. Distributed teams will benefit more from this process than co-located teams.

Team Temporal Dissonance

When a team has two shared salient cognitions which contradict each other, the team will feel a tension. This tension is cognitive dissonance. In a similar fashion, teams can feel temporal dissonance. They can have multiple incongruent attitudes about time contained in the temporal structures of the team and of the team's stakeholders and environment. If this lack of congruity has been made salient, the team may suffer from tension while trying to resolve the competing demands. This reaction is temporal dissonance. It is perceived as a tension among the team members. A lack of temporal congruity is a necessary, but not sufficient, condition for team temporal dissonance to exist. The lack of congruity must be made salient, and a reaction from the team members must come from that lack of congruity.

We provide four examples to show when temporal dissonance is – and is not – generated, summarized in Figure 15, Figure 16, Figure 17, and Figure 18. In the scenario, there are four members on a work team: Alice, Bob, Carol, and Dave. They individually have temporal characteristics of chronicity, chronotype, and temporal focus.

In Figure 15, we see that all members of the team are owls, and they are required to meet in the late afternoon. Because of this, the temporal congruity of the team on chronotype is high, and the salience of chronotype is also high, since there is a requirement for meeting at a particular time. In this situation, regardless of the salience, the temporal dissonance will be low – the team has an agreement about what its chronotype is, and so has no problem coping with the meeting time requirement, which also agrees with their chronotype.
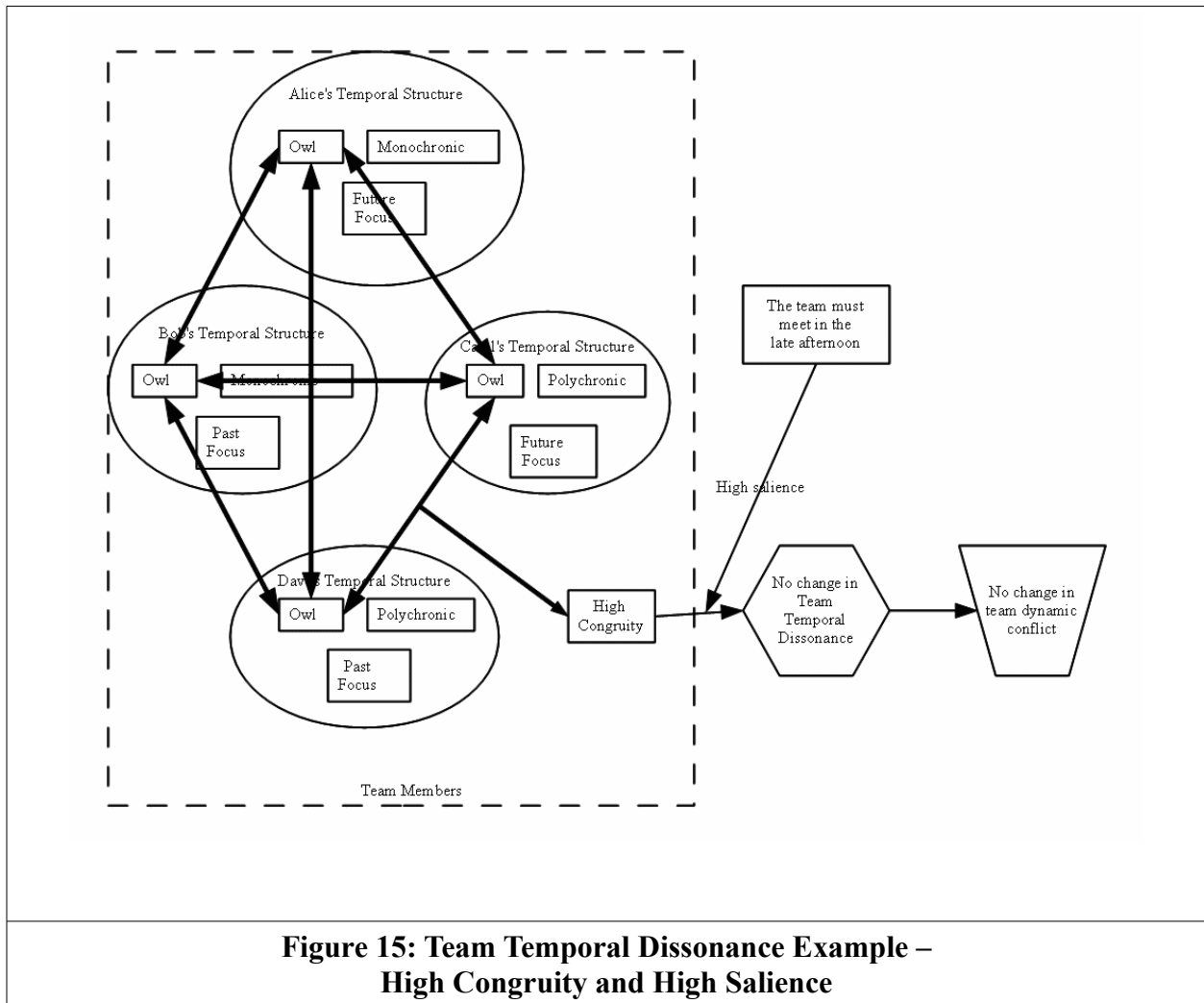
Figure 15: Team Temporal Dissonance Example –
High Congruity and High Salience

In Figure 16, Alice and Bob are monochronic, while Dave and Carol are polychronic. This means that the team has low temporal congruity. However, the tasks that the team members are performing for their team are highly independent. Because of this, it doesn't matter to Dave and Carol that Alice and Bob work on one task to completion, then start the next. Dave and Carol can multitask as they wish. Similarly, Alice and Bob are left to do their work sequentially as they prefer. Because of the low salience of the characteristic of chronicity, temporal dissonance does not develop in this situation.
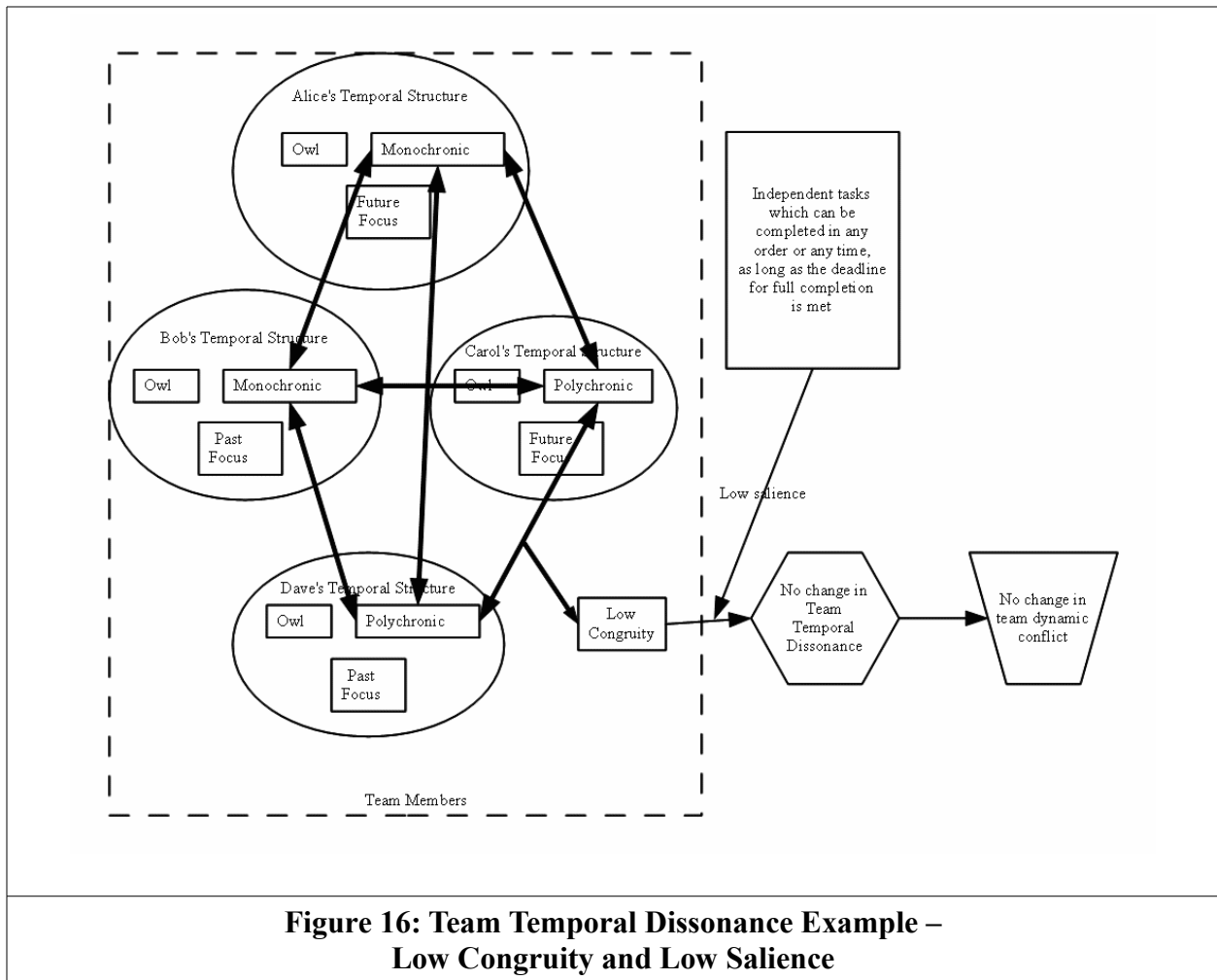
**Figure 16: Team Temporal Dissonance Example –
Low Congruity and Low Salience**

In the third situation, in Figure 17, all the team are owls. The company has instituted a policy which allows workers to shift their work hours to better suit themselves. Since the tasks are independent, working time doesn't matter; but, in fact, the whole team decides to work later in the day, since they are all owls. In this situation, with high congruence and low salience, temporal dissonance does not develop.
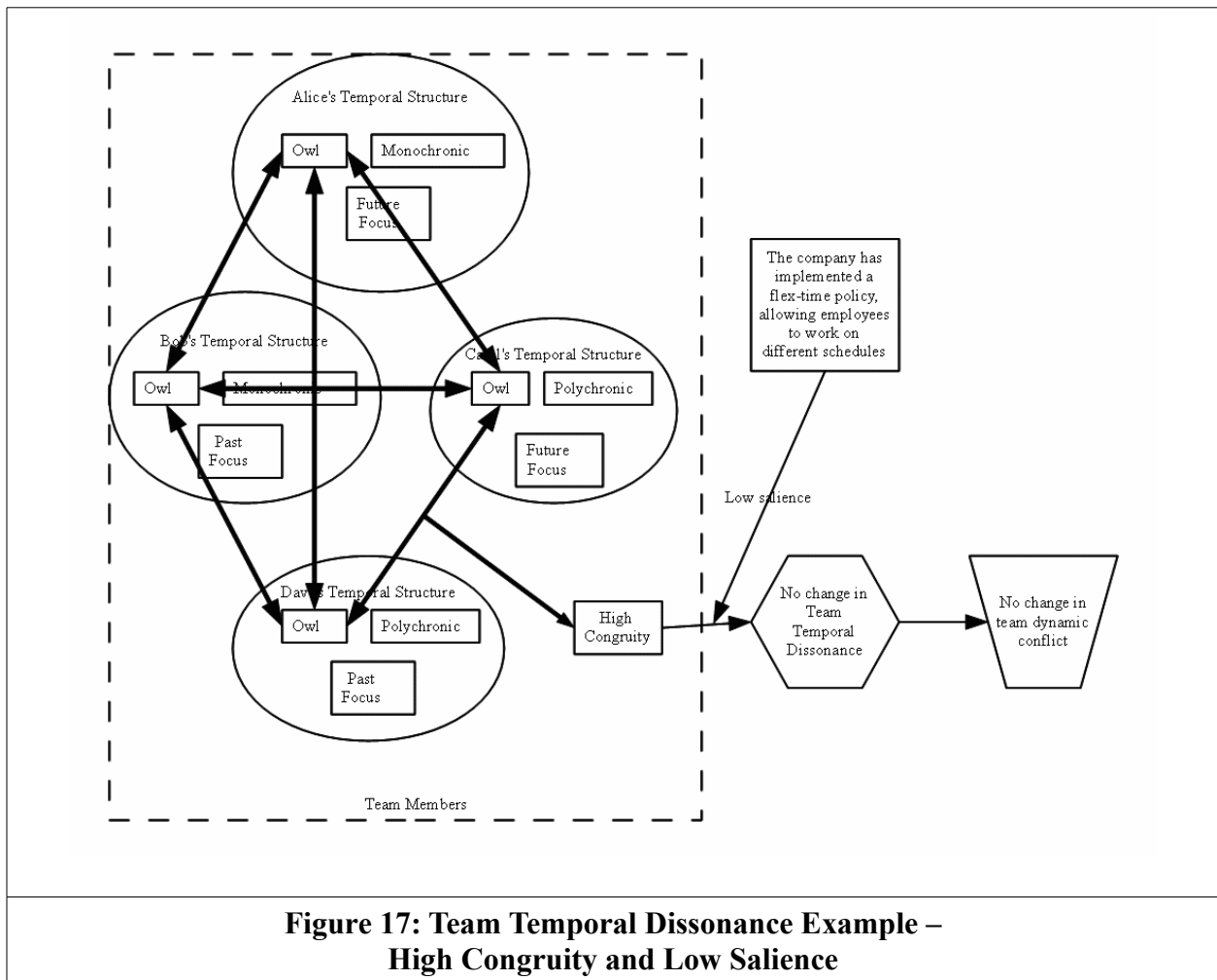
Figure 17: Team Temporal Dissonance Example –
High Congruity and Low Salience

In the last situation, in Figure 18, Alice and Carol have a future focus, while Bob and Dave are past-focused. This means that there is low temporal congruity on the team. The task they are performing requires that they predict how the company will be doing in the future, and plan out a strategy that will cause it to grow and enter new markets over the next ten years. This makes the temporal focus a salient characteristic. Because of this, there will be significant tension between Alice and Carol on one side, and Bob and Dave on the other, over the focus of the team. Thus, when congruity is low and salience is high, the team will suffer temporal dissonance.
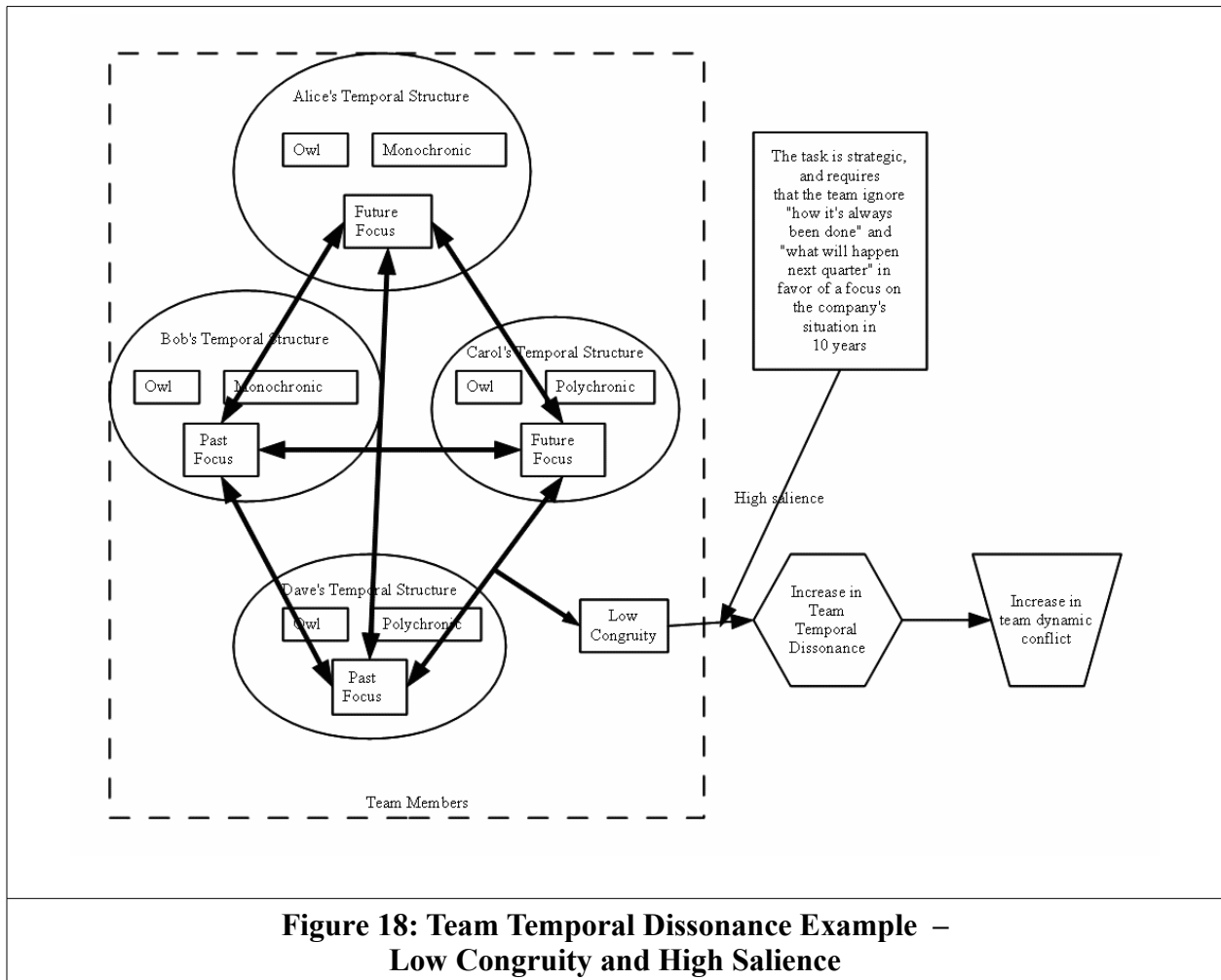
**Figure 18: Team Temporal Dissonance Example –
Low Congruity and High Salience**

The salience of the team temporal congruity is a factor which has been largely ignored. However, it is critical for the formation of temporal dissonance. When team members' individual temporal structures are not congruent with the team's temporal structures, team performance suffers (Bluedorn & Denhardt, 1988). However, as we have just seen, the incongruity itself does not cause the tension.

The studies which have found temporal congruity to predict performance had implicitly high levels of salience for temporal characteristics. For instance, the task used in Gersick and in Labianca et al. had a time limit of one hour. During this time, the teams needed to generate a script for, and then produce, a short advertisement (Gersick, 1989; Labianca et al., 2005). This task puts time pressure on the team, and makes temporal characteristics salient. Thus, those teams with a low level of temporal congruity were likely to suffer temporal dissonance.

When a temporal characteristic is not salient, then it does not matter what values that characteristic has. It is not salient, and so it will not come up for consideration by the team members. They may well have differing ideas of the team's structure, such that there is, in fact, no value for that characteristic in the shared mental model of the team. In a similar fashion, if there is perfect congruity, the team is able to establish a temporal structure trivially. All members have the same temporal structures, and the environment has the same temporal structures, so the resulting emergent temporal structure for the team will be identical to all those. The only time that the temporal characteristics become an issue is when there are differences, and the characteristics are salient.

When there is a salient lack of temporal congruity, the team will suffer tension as the team members seek to resolve the temporal conflicts, either through salience reduction or

modification of team temporal structures, and this can result in tension. If the tasks that team members perform are highly interdependent, and the team expects to perform work polychronically, the worker who fully completes one task before starting the next will generate tension on the team. If other team members are forced to wait, they will feel frustrated with the team member who is not working in the fashion the group expects. The monochronic team member will feel this pressure as well. This group tension may erupt in conflict between the group members in an attempt to resolve the temporal dissonance being evidenced.

> *Proposition 7: The interaction of salience and team temporal congruity leads to team temporal dissonance. When team temporal congruity is low and salience is high, then the result will be high team temporal dissonance. When either the salience is low or the congruity is high, there will be less team temporal dissonance.*

Affect, Process, and Task Conflict

When individuals experience cognitive dissonance, they change their attitudes and beliefs, seek supporting or disconfirming evidence for competing attitudes, or change their behavior or their environment in order to reduce the dissonance (Aronson, 1969). Teams experiencing cognitive dissonance work to reduce their dissonance, through conflict among the members promoting the conflicting attitudes until the dissonance is reduced. In a similar fashion, teams which are experiencing team temporal dissonance will seek to reduce the tension associated with the team temporal dissonance. This can be accomplished by marginalizing some of the dissonant temporal structures. Because the temporal structure is a trait of one or more of the team's stakeholders, marginalizing the dissonant structure is a marginalization of a

stakeholder's trait. This is inherently an affective process, in which the value of a stakeholder's trait is diminished in the view of the team. Thus, this marginalization is an example of affect conflict. Alternatively, the team may seek to strengthen a particular temporal structure. This can take the form of promoting a particular stakeholder's temporal construct in a similar, though opposite in effect, process as the aforementioned marginalization. This effect has been seen in the literature, in that team members whose chronicity more nearly matched the organization's professed chronicity perceived that they were evaluated more highly, and had a stronger affective commitment to the organization. Thus, increased temporal congruity was observed to correlate with reduced affect conflict among the team members (Slocombe & Bluedorn, 1999). However, as we have mentioned before, the congruity itself cannot have caused the conflict; it is the affective reaction to the congruity that produced the affect conflict.

Proposition 8: An increase in temporal dissonance leads to an increase in affect conflict.

Teams engage in process conflict in order to resolve conflicting views concerning resource allocation or team processes. This can be very debilitating for work teams. Teams which perform well flow through a process in which they gather information for about half the available time, then undergo a rapid transition, switching into a performance mode. When this transition is disrupted due to process conflict (e.g., scheduling or deadlines) the team performs more poorly, or may become completely dysfunctional (Gersick, 1988, 1989). This conflict can be intensified by contextual events which interact with the team members' perceptions of time. For instance, when short-term teams start and have a deadline at "prototypical" times (on the quarter-hour; e.g. 10:15 or 11:00), they perform better than teams that have start and finish times

at non-prototypical times (e.g. 10:07 or 9:34) (Labianca et al., 2005). These latter teams have their sense of time so thoroughly disrupted that some do not even complete their task.

Teams may attempt to resolve conflicts by changing the behavior of the team or its environment. This is achieved by changing team procedures, by changing the makeup of the team, or changing team requirements or conditions. These mechanisms are another example of process conflict. Additional process conflict can occur when the temporal structures of a team are dissonant. When there is high team temporal dissonance, the team is unable to structure its time. When it cannot structure its time, it will likely fail to make the transition from information gathering to performance (Gersick, 1988), and this disruption in the group development process is another example of process conflict.

Proposition 9: An increase in temporal dissonance leads to an increase in process conflict.

The third type of team dynamic conflict, task conflict, concerns differences in proposed ways to perform the task put before the team. In general, this task will not itself have temporal components. The temporal components that may typically exist (for instance, a schedule or a deadline), are matters for how the team is required to work, and thus possible contributors to process conflict. Since the actual task is unlikely to have temporal components unrelated to the way a team functions or allocates its resources, we do not anticipate any direct effect on task conflict from team temporal dissonance.

Performance and Affective Outcomes

While this theory will not go beyond team dynamic conflict as a dependent variable, prior research has established that affect and process conflict reduce team performance. Thus, the

increased dynamic conflict created by temporal dissonance will be felt by the team as a reduction in performance, and will also have an impact on affective outcomes such as job satisfaction and cohesion.

Discussion

This conception of temporal dissonance now gives us tools with which we can better understand outcomes such as those found by Maznevski and Chudoba, and by Labianca et al. It also gives a way to understand when, and what kind of, time management intervention might work. We believe that this is a rich model which opens the way for substantial theorization in the future.

A New Look at Prior Work

Maznevski and Chudoba found that distributed teams that had regular meetings were more productive. Our model enables us to suggest the following mechanism for the observed results, as follows. In distributed teams, team members' ability to interact socially, in a way that allows them to share characteristics and come to a consensus about team characteristics, is impaired. As situations shift and change, the other temporal characteristics – characteristics which have not been considered by the team as a whole – might become salient. Individual team members will tend, in such cases, to assume (by anchoring) that the team characteristic matches their own, and work in that fashion. However, this will not always be the case; it may be that, once the team as a whole considers the characteristic (either consciously, or unconsciously), a different value may be selected. Now, in addition to the conflict that has happened because of the temporal dissonance, there may be additional affect or process conflict due to the way work was

done, by individuals whose temporal structures differ from the chosen structure, prior to the team consensus. This risk can be considerably reduced by engaging in regular face-to-face meetings. Such meetings will both reduce the lag time during which team members may operate under differing temporal structures, as well as leading the team members to the expectation that at the periodic meetings team characteristics will be refined. Being aware that this happens on a regular periodic basis may also work to reduce the salience of the disputed characteristics, and/or reduce the resistance team members might have to the team characteristics.

For another example, Labianca et al found that teams which started at non-prototypical times suffered a drop in performance. Since the lumping of time into 15 minute increments is a temporal characteristic, our theory can provide analytical tools. This characteristic lacks congruity when the team is started at non-prototypical times, as this leads some team members to focus on the previous 15-minute mark, and other team members to focus on the following 15-minute mark. Because the time limit is strict, this lack of congruity is salient, and the team has difficulty coping with the time. This type of lumping is more a cultural difference than an individual difference; for this reason, it is likely that all non-prototypical teams had the same difficulties, more or less. A very interesting extension would be to repeat the experiment with people from a culture which differs on time chunking; for instance, some Asian cultures consider time to be less divisible, and might not have the same problems with starting at slightly different times. It might also be that the individual characteristic of temporal focus could come into play. Those who focus on the past may effectively consider the team to have started at the previous quarter-hour break, and thus feel that the team has less than an hour to go, and thus may be more time-aware than a person with future focus. The person with future focus might anchor on the

subsequent quarter hour, thus considering the first few minutes as extra time. The latter seems to be the focus found by most in Labianca et al.'s study, which may not be surprising; there is probably a tendency for Americans to be somewhat future-focused in general. Given the shift in starting times, temporal focus would probably be salient, and measuring it in a replication would be one way to test the theory of temporal dissonance.

A New Understanding of Time Management

While it has been known for some time that congruent time structures can result in better performance in individuals, teams, and organizations, the process has not been understood. This research provides a partial explanation in the form of temporal dissonance, which occurs when salient temporal structures lack congruity. In the team, high temporal dissonance leads to higher team affect and process conflict, which is known to reduce performance. This opens up a number of interesting research possibilities.

First, this research presents a theoretical model for a new construct, team temporal dissonance. We place it into its immediate context, showing how individual and emergent team temporal structures can lead to team dynamic conflict. While we believe that our argument is persuasive, and explains some previously contradictory research, empirical verification would obviously strengthen the theory. The creation of a temporal dissonance scale to operationalize this construct will significantly aid future research. With such a measure, the existence of temporal dissonance can be demonstrated, and its place in the nomological network can be confirmed. This will also enable characterization of the impact that temporal dissonance has on the workplace. It will also allow more thorough investigation of more distal antecedents (such as the temporal characteristics themselves), a better understanding of what circumstances create

salience, and a more thorough understanding of the consequences beyond a simple increase in dynamic conflict. Because this is a new construct, it would be particularly valuable to measure temporal dissonance in an experimental setting, allowing manipulation of the proposed antecedents. The burgeoning use of neuroscience techniques might also be an aid; since temporal dissonance is an affective response, its activation should be visible as alterations in the neural activity of team members.

There has been much research on the efficacy of time management techniques, with mixed results. The existence of temporal dissonance can explain both how time management actually works, and why it does not always work. The key to understanding why it does not always work is that time management techniques (such as entrainment) work to increase temporal congruity, but do not alter salience. As we have seen, simply increasing temporal congruity will not necessarily increase performance; it will only increase performance in situations where the lack of temporal congruity is salient and so has created temporal dissonance. Thus, time management techniques which aim to increase temporal congruity will only be effective when there is a salient lack of congruity. By increasing congruity, time management techniques can reduce temporal dissonance when the congruity is salient. However, if there is no lack of congruity, time management cannot increase congruity, so it cannot reduce the already low temporal dissonance; there is simply no benefit. If there is a lack of congruity but it is not salient, then increasing the congruity will not reduce the again already low temporal dissonance. It is only when there is some lack of congruity for time management techniques to operate on, and the lack of congruity is salient, that the use of time management techniques will reduce temporal dissonance. This interaction helps explain why the efficacy of time management

techniques has been unclear.

This research identifies a set of characteristics that may affect how individuals and teams interact with the organization and with their environment at large. While no one in the modern business world would condone the criticism of employees based upon age, sex, race, disability, or a number of other inherent characteristics, the stereotypes of people based upon their temporal characteristics is commonplace. Understanding better that these differences are a matter of physical and psychological essence, rather than moral culpability, will help improve relationships between individuals and teams with differing temporal structures. Additionally, understanding those differences, and how they can and cannot be modified, will help produce interventions that can reduce employee stress, increase employee performance, and improve affective results such as turnover intention, negative affect, and reduced motivation.

An understanding of temporal dissonance also provides a clearer picture of the mechanisms by which a manager can reduce employee stress. By reducing temporal dissonance, employees should be happier and perform better. Because temporal dissonance is created by an interaction between salience and temporal congruity, the manager can intervene in either to reduce the incidence of temporal dissonance, thus improving employee welfare.

The incorporation of multiple characteristics in this framework enables researchers to more thoroughly examine situations in which temporal structures lack congruity. Most research to date concerning temporal congruity has focused on single characteristics. Our framework makes clear that differences in one characteristic may not actually create issues in teams. As a corollary, multiple characteristics being slightly out of congruity may in fact create more temporal dissonance than single characteristic differences. Multiple characteristics and temporal

dissonance need to be included in temporal congruity research to more richly understand the consequences of those differences.

Future Work

Other Levels of Temporal Dissonance

Very little of our argument is specific only to small groups. There is no reason to believe that team temporal dissonance cannot be generalized to departmental, organizational, national, or cultural temporal dissonance. The main difference is likely to be in the outcomes. We have related team temporal dissonance to the processes of team dynamic conflict. The concepts of team dynamic conflict are not known to work at organizational or higher levels; the forces at work there may be different, such as the mimetic, normative, and coercive forces that shape institutional isomorphism (DiMaggio & Powell, 1983). If, and how, temporal dissonance might work at higher levels remains an open question.

Cross-Level Effects

It seems obvious to generalize temporal dissonance to both individual levels, and to higher levels such as departmental or organizational. In such a multi-level model, there may be profound cross-level effects that we lack space to explore in this paper. For instance, team entrainment works by bringing team members' mental models of the team temporal structure into better alignment, increasing the team temporal congruity. However, the resultant team temporal structure may actually be less congruent with the individual's temporal structure. The fact that the team feels the need to make this change indicates that the temporal characteristic being entrained is likely salient. The change in the individual's temporal congruity with their team due

to team entrainment is unpredictable at a theoretical level; it might increase an individual's temporal dissonance, or decrease it. For this reason, all we can say is that team entrainment changes will affect individual temporal congruity via the mediation of the team temporal structure; and that, since the salience is likely high, this will probably change individual temporal dissonance. In an operational context, this will be more amenable to prediction. As an example, a team which has had conflicts about meeting times may decide arbitrarily to have all team meetings in the morning in order to end the argument. This reduces the conflict over when meetings will occur, and allows the team to focus on the task at hand rather than process-related issues of when meetings will be held. The team temporal dissonance is reduced, leading to an increase in performance due to reduced process conflict. However, this will force the owls on the team to cope with increased individual temporal dissonance, due to having to work in the morning rather than the evening. They may also engage in affect conflict with the larks on the team.

If there are few owls on the team, the losses due to the increased individual temporal dissonance may be small, meaning that overall, team performance will increase. However, consider the case where the team consists of mostly owls, and the meeting time decision is made by their team leader, who is a lark. The team leader has reduced the team temporal dissonance, and her own individual temporal dissonance. Yet, the vast majority of the team has had their individual dissonance increased, reducing their performance. The resulting loss in performance by the individual team members is likely to more than cancel out the increase in team performance due to the reduced team temporal dissonance.

This theory has focused on team level temporal dissonance, which only occurs when

individuals have created emergent team structures. By the same process, it seems likely that the concept of temporal dissonance can also play a role in departmental, organizational, and even institutional or cultural levels. Since these higher level groupings create their shared cognition from their constituent groups, similar forces will be at play to create more abstract levels of temporal dissonance. Teams within departments will compete with each other to create departmental time structures, which can create departmental temporal dissonance. Conflicts between departmental temporal structures could potentially lead to organizational temporal dissonance. Organizations themselves will contend with each other to define broader senses of time, thus creating institutional temporal dissonance. This may even extend to broad cultural clashes as well, driving toward Hofstede's notion of culture-wide characteristics (Hofstede & Hofstede, 2004).

We have contributed to an understanding of environmental and internal forces that underlie the creation of dynamic conflict in teams. With this theory, we have tried to open the black box that existed between temporal congruity and team outcomes. We have done this by integrating a nuanced adaptation of cognitive dissonance theory and incorporating the conflicting requirements created by multiple temporal structures within the team. This creates a richer framework for understanding some of the interactions that teams have with the temporal aspects of their environment. Temporal dissonance should prove to be a useful lens for future theory development and a better understanding of how managers can improve the use of time in their organizations.

Implications for Practice

Temporal dissonance represents a new understanding of the mechanisms by which

temporal characteristics affect team development and function. An awareness of the potential for temporal dissonance can therefore aid the manager wishing to ensure successful team performance. As one example, if a team which started at a non-prototypical time were made aware of that fact, and that team members might interpret it differently, the team can take a short amount of time to ensure that they create a congruent temporal structure for understanding the time remaining to deadline. This might have improved the performance of the teams which started at such odd times.

Since time management interventions are ways of structuring time, they may have an impact on team temporal structures. To the extent that they make salient temporal characteristics more congruent, they are likely to be effective. However, such techniques which operate on non-salient characteristics, or on characteristics that are already congruent, are likely to be less efficacious. Knowing whether, and which, time management techniques to implement will have significant practical value.

Implications for Research

Our theory provides an integration of theories of group development, cognitive dissonance, and temporal congruity to help explain the mechanisms by which temporal characteristic differences can affect team development and team performance. It provides a partial answer to the question posed by Labianca and colleagues, about how team cognition concerning temporal characteristics affects group development and performance (Labianca et al., 2005).

Conclusion

At the beginning, we asked the question " What is the mechanism by which temporal congruity affects team performance?". We have provide one answer, which is that, when temporal congruity is made salient to a team, that it can create a sense of temporal dissonance in the team. This temporal dissonance is felt as a tension within the team. The team naturally tries to reduce this tension, which can be done in two ways: by questioning the rules under which the team operates (process conflict), or by attributing the tension to individuals and attempting to reduce the tension through affect conflict. Further, temporal dissonance can impede the emergence of some team temporal characteristics, which can then disrupt the team development process.

Essay 4: Under the Gun: How Affect Conflict in Teams Experiencing Temporal Dissonance Due to Deadline Pressure Can Improve Team Performance

Abstract

In a study of two teams under differing deadline pressure, we were startled to find that the team that had multiple, shifting, externally imposed important deadlines performed better than a team which had a single self-imposed deadline. In examining the group processes, we discovered that the higher-performing team engaged in a pattern of affect conflict which reduced tensions raised by the imposed deadlines. We propose that the teams both had a form of team temporal dissonance; but that since the higher-performing team's temporal dissonance was generated by out-group conflict, in-group affect conflict reduced tension, which is contrary to the normal result of affect conflict. The single-deadline team's dissonance was due to in-group differences, and thus affect conflict raised tension in the team as expected, reducing its performance.

Introduction

Project failure continues to be a serious concern for business. Such failures are most troubling when the project is itself time critical. IT projects seem to be particularly prone to time critical project failure (The Standish Group 1995). Since some of the major causes for these failures seem to be related to relationships, scheduling, and motivation (Sessions 2009), we undertook to study group processes in IT teams. Our goal is to better understand deadline pressures – particularly the pressures caused by rolling deadlines – and how they might increase the likelihood of failure.

Many researchers have described the observable group dynamics of working teams.

However, the specific pressures of deadlines raise the issue of temporal characteristics. Each individual has a unique set of temporal characteristics, which interact to form the unique set of emergent temporal characteristics in a team. The interaction between all of these temporal characteristics, both individual and team, has not been widely studied, particularly in cases when the team, and its tasks, continue to evolve through the course of a project. We felt that a closer examination of how teams develop a sense of time and use time, and how this affects relationships between individuals and the team, would allow us to be able to better understand how teams meet, or fail to meet, deadlines under field conditions. Thus, our research question is: How does differing deadline pressure affect team performance?

The effect of deadlines on teams has received some attention in the past. Waller and colleagues explored the effects of differing individual deadline styles on group process, producing a typology of styles to predict the effects of interactions between deadline styles and temporal perspectives (Waller, Conte, Gibson, and Carpenter 2001). Teams do seem to pace their work to expected deadlines, increasing attention as they near the deadline (Waller, Zellmer-Bruhn, and Giambatista 2002). This pacing seems to derive from an emergent group clock, which drives transitions in group focus at the midpoint of projects (Gersick 1988, 1989), although this group clock can be disrupted by manipulating team member temporal perceptions (Labianca, Moon, and Watt 2005). This work has also examined what happens when deadlines change (Gersick 1988; Waller et al. 2002) and when there are multiple deadlines (Gevers and Peeters 2009). This work has helped us to understand how such elements work in isolation, but little work has combined these elements. This is a serious gap, because, in practice, real IT teams routinely face multiple changing deadlines with more complex considerations than are possible

to create in a laboratory setting. It seems quite likely that multiple shifting deadlines would prove much more challenging for a team than the individual components lead us to believe. Further, most of this work has involved student teams, which may not reflect the realities of teams in the workplace. Waller and colleagues explicitly include a call for further research on the effects of deadlines on actual business teams (Waller et al. 2002).

Time as a subject for research has only recently been widely explored (Ancona, Goodman, Lawrence, and Tushman 2001). Time is a complex phenomenon, which can be described from many different frames of reference, including biologically, psychologically, socially, or physically (Ancona, Okhuysen, and Perlow 2001; Conway and Limayem 2010; Street and Ward 2011). In most past work, one particular type of time is selected to be "time", which is then considered to be invariant and universal. This can be as simple as clock time or waves of data collection in a longitudinal study, or viewed in a somewhat more complex fashion such as event time (like "banana time") or cyclic time (like the "wheel of time").

Common to most prior research is the view that time itself is an external, immutable, inexorable force which can be perceived, but not manipulated by people. There is an objective time which people may differ in interpreting, but which does exist separate from the observer. However, this paradigm has been challenged in two ways. The first challenge comes from the kind of economic view of time that some people take. This comes out in the way the people talk of "wasting time", "spending time", "saving time", "scarcity of time", and so on (T. Hellström and C. Hellström 2002; Yli-Kauhaluoma 2009). While this different way of viewing time does exist, it has rarely been used in research, and is generally considered more metaphorical than real.

The second challenge is that, physically, time may not even exist. Viewed at their extremes, fundamental theories of physics do not view time the same way. In relativistic physics, time may move more or less slowly, depending upon our relativistic frame, which eliminates the unchanging notion of time (Clark 1985). Theories have suggested that time may have flowed more slowly or more quickly in the distant past, near the big bang. Quantum theory views time as completely reversible; in this view, there is no way to tell the difference between an interaction happening as time moves forward, and the converse interaction happening as time moves backwards. Many combinations of quantum and relativistic theory result in the complete elimination of time as a dimension.

Failing a solid physical basis, the evidence is that time must be primarily socially constructed. As such, the various ways of experiencing time are no longer simply different perspectives on the same phenomenon, but are fundamentally different constructions of reality. This suggests that time must be considerably richer and may be considerably more important to human interaction than has previously been thought. As such, the social construction of time may be the key to understanding why some teams fail to meet deadlines, while others succeed. In real world teams, as deadlines are added, changed, or dropped, this social construction takes on even more importance.

The ideas presented here began with a field study of teams under deadline pressure. The question that drove the research was, Do teams facing multiple changing external deadlines perform less well than teams facing single internal deadlines? We focus primarily on team interactions while under deadline stress, rather than team process or attitudes toward deadline. Prior research has taken deadline pressure as a given stress; we wished to develop an

understanding of the ways that variable deadline pressure affects team performance. A qualitative approach presented a better opportunity to observe deadline behavior *in situ.*

In an ideal world, such a study would involve shadowing all team members constantly through the lifetime of a project. If we could observe all the professional behaviors of all the team members, and then observe how this resulted in team interactions and team performance, we would doubtless be able to get a much clearer picture of the actual importance of time. We would then be able to characterize its use by the team and its relationship to individual methods of interacting with time. However, such an obtrusive study has profound limitations. Either the observation will be very obvious and possibly affect the way people act and interact (if using human observers), or the hardware required (for video surveillance) will be expensive, disruptive, and violate the privacy of individuals not part of the study, while probably missing data that might be very important, such as lunch outings that move beyond the area of surveillance. Additionally, both methods would generate intractably large reams of data.

We have compromised by gathering data in two fashions. The first was through attendance at team status meetings, which were recorded. By attending these meetings, we felt that we would reduce our obtrusiveness as observers (since the meeting already held multiple people anyway), but we would be present in one of the major areas of full-team interaction. We expected that important temporal components would be made salient at these meetings, since the meetings are primarily geared toward understanding and making progress on team projects. These types of meetings are themselves a method of entraining team time perceptions (Ancona and Chong 1996).

We supplemented the team status meetings with individual interviews. This allowed us to

more fully explore the affective reactions between team members in a safe environment, unlike the team meeting. We could also more directly explore the temporal characteristics of the individuals in this fashion, rather than the temporal characteristics of the team as a whole, which we perceived from the team meetings. Finally, we used a quantitative survey of one team's members to anchor our research more firmly into the quantitative streams of temporal research.

This research attempts to generate new theory. Rather than refuting old theory, we hope to extend and enlarge the nomological net, particularly in the area of deadline pressures. As such, we will describe old theory as it is relevant to our work, and attempt to show how our work expands the realm of available theory.

Methods

We performed our study with two kinds of teams. One team had a single project with an internally-generated deadline. The other team had more than one project with more than one externally-generated deadline occurring over the course of our study. We planned to gather recordings of team status meetings, notes from an observer, and individual interviews with team members. Once all of this data was gathered, we planned to examine the temporal characteristics of the team as a whole.

As we examined the transcripts of one team's status meetings, we noticed a curious thing. Whenever the issue of deadline was brought up, someone would quickly follow with jokes or insults about other team members, users, or other teams. After a short period, the meeting moderator would make remarks concerning the plan for working on the task, which would bring the team back onto topic, and it would then remain on task for an extended period of time. This

intrigued us; we then began to look at other mentions of time in the transcripts, and found many instances of a similar pattern. This type of highly idiosyncratic affect conflict did not fit prior models. They seemed to be some kind of episodic punctuation. This is not quite the same model as Gersick's punctuated equilibrium (Gersick 1989), nor does it match Tuckman's five stage model (Tuckman and Jensen 1977). These periodic interruptions seemed to serve a specific function as stress relief in the team. Noting this, our attention will be dedicated to exploring the observed affect conflict, which may provide unexpected clues to team use of time.

In a qualitative study of this type, it can be difficult to adequately limit the research domain. Because we were interested in the effects of different amounts of deadline pressure, which might vary from one company to another, we wanted to select two teams at a single company which were facing different levels of deadline importance. We also wanted teams that were doing the same general type of work; in this case IT teams doing some programming support and some user support. These two parameters were felt to be an adequate limitation of possible confounds due to environment and task.

The teams we observed were two IT groups from the same company, located in the southern United States. This is a large company with many remote sites. The teams monitored were part of the corporate headquarters complex, which was spread over several buildings in the region. This enabled us to be sure that the differences we observed were not due to differences in corporate culture. The teams did vary in size, type, and deadline intensity. The first team was relatively small, with generally four active participants. This team primarily provided front-line support for a third-party application, with a small amount of programming to customize the application to the organization's needs. The deadline they faced was internally defined by the

team itself; they had recently had an incident which made important customers unhappy. In order to prevent recurrence, they were formalizing a user support plan. They needed a solution "soon", but had no externally provided deadline. The team did not generally provide programming support of the software system; generally software changes were handled by the third-party provider, although they did perform some small customizations. We will refer to this team as the "HALL team".

The second team was larger, with generally ten active members, two of whom were remote. They faced multiple, well-defined, important, external deadlines for the implementations of the application that they worked on; these deadlines were frequently changed by external stakeholders. These deadlines were for rollovers and initial implementations at remote sites, which were coordinated with several other groups and the plant. The application was a third-party software package for which the team wrote and supported customizations for the company, with some limited front-line support of the application. They were implementing user change requests, fixing bug notices, and dealing with changes needed due to site-specific requirements. At the time of this research, they were involved in rolling implementations at multiple sites. Each implementation involved several other corporate teams, which made the deadlines very important. Some implementations were upgrades to the application already at the remote site; others were "big bang" initial implementations of the software. We will refer to this team as the "TREE team".

At the first meeting of each team attended by an observer, the team was told that the observer was there to perform a research project on how teams worked together. They were given a brief explanation of the process for qualitative research, and informed that no personally

identifiable information would be released to anyone for any purpose. They were told that they had the right to decline to be recorded, and the consent of all team members was requested for recording. When all team members agreed to allow recording, the recording began. At subsequent meetings, because the meeting attendance varied somewhat, the observer would give a much briefer explanation of their presence, and told them that if they did not wish to be recorded they should inform the observer. This protocol was approved by the university IRB.

The primary data consisted of two types of audio recordings. The first were of team status meetings. These happened once a week for both teams. The TREE team had a regularly scheduled meeting, every week at the same time. The HALL team, while it typically met once a week, scheduled those meetings *ad hoc*. The observer also took notes as to body language or visual aids used during the meetings. The audio recordings were transcribed by a professional transcription team. The second set of audio recordings were one-on-one semi-structured interviews, based upon the observations of the teams made to date. These interviews started with broad, open-ended questions, later focusing more closely on time use questions. These recordings were also transcribed by a professional transcription team.

Because we were interested in emergent phenomena related to deadline pressure, we did not impose a structure on the transcripts and notes at the start. Instead, we utilized the open coding method, in which a coder defines codes by what they see in the transcripts.

The coding was performed by a PhD student who was familiar with, but not directly involved in, the research being undertaken. The coder was given a few categories of things to particularly notice, specifically mentions of time or indications of conflict or tension. However, the coder was free to define the actual codes and their meaning as they read the transcripts. Their

overall job was to be able to create a story about the meeting flow, with an emphasis on how the team considered and performed their tasks. The coder used RQDA version 0.2-2 to perform the analysis. The researchers used the RQDA project produced by the coder and further R version 2.15.0 functions to do examine patterns and structure in the data.

We did not begin our analysis with any specific structure in mind. We identified a few constructs that we expected to see; specifically, deadlines, task conflict, affect conflict, and process conflict. The data would decide what other constructs might exist, and how they would relate to each other. We expected that an overall model of "what is the team discussing now, and how does it lead to what they discuss next", but what precisely the constructs were, and precisely how they related, we allowed to emerge from the data.

As we began our analysis, we were expecting to see the typical deadline-related patterns described by Waller and colleagues (Waller et al. 2001), Gersick (Gersick 1989) and McGrath (McGrath 1991). Primarily this encompassed a focus on deadline which increased as the deadline approached, and a transition at the midpoint of the task. However, as we examined the transcripts, we realized that we were seeing a somewhat different pattern, marked by an occasional reinforcement of the importance of the deadlines. In this new pattern, the team was more aware of these deadlines than expected. Deadline reinforcement generally consisted of a brief affective reference to other teams' lack of deadline responsiveness. We used this revised model and continued through the rest of the transcripts to see if that pattern remained. We then made a generalization of the pattern, and went through the transcripts again to see if that pattern held throughout. We continued this process until we reached a point where we could not see any significant additional elements which did not fit the most recent iteration of the pattern.

We expect that each interviewee's models of the team meeting process may vary from the others, and from that observed by the researchers, since every individual has their own model of the reality that they perceive. Each model may have more, or fewer, or different steps. We will need to maintain a model for each-- the researcher's model, and the individual interviewees' models-- until all the interviews are analyzed. At this point, all the models should be stable. Comparing the models at that point, we expect, will provide further insight into how the teams functioned.

Qualitative data is inherently less deterministic than quantitative data. The goal of qualitative data is to come to a broader understanding of the themes and models that are specific to the individuals being analyzed. As such, the results we present are inherently subjective, based upon interpretations of broad patterns perceived in the recorded team interactions. A case study such as this allows for considerable depth in the analysis, but possibly restricts the generalizability due to the specificity of the case itself. As such, qualitative data provides only an outline of what reality may be, and should be combined with quantitative data (and vice versa) in order to obtain a full understanding of the underlying reality (Eisenhardt 1989; Glaser and Strauss 1967; Miles and Huberman 1994).

Results

In some ways the teams worked similarly. Both checked on clock time (about 0.5% of the codes), and made sarcastic references to the amount of available time (about 0.33% of the codes), and complained about conflicting demands on time (about 3% of the codes). There were, however, more differences than similarities.

The HALL team spent much of its meeting time focused on the task at hand and in task conflict (about 37% of codes). Discussion of the task were found primarily in combination with the deadline for support response and the workflow for help tickets. There were frequent forays into process conflict, which was associated with scheduling issues and focus on how the task was done in the past. Another frequent shift was to frustration with the users (associated with process conflict and workflow definition), and with a concern about "that's not our job", which was also associated with workflow definition. There was some affect conflict, which tended to happen in association with process conflict, and with the task workflow. HALL was more frustrated with the users (3% versus 1%), and made more "that's not our job" remarks (4% versus 1%).

The TREE team spent its time somewhat differently. While again much of the meeting time was spent on the task at hand and in task conflict, this totaled about 43% of the time, more than HALL did. The team spent nearly twice as much time on affect conflict (7% versus 4%), and over twice as much time discussing deadlines (11% versus 5%). They spent less time focused on the past (0.25% versus 2%). TREE felt that there were fewer conflicting demands on time. Remarks that indicated stress were more common (4% versus 0.25%), and were associated with sarcastic remarks about the availability of time and instances of affect conflict, which were almost always followed shortly by instances of process conflict. We found this to be most interesting. The instances of affect conflict tended to take the form of insults. However, the team seemed to view these generally positively; there was a release of tension as the team, including the insulted party, laughed together. The moderator was then able to bring the meeting back into line with a reminder about the process to be followed.

Figure 19 shows how remarks about deadline triggered other remarks in the two teams.

The percentages do not add to 100 because we have simplified the tree by omitting paths that were similar between the two teams. For the HALL team, remarks concerning deadline were followed much more often by process conflict (56%) than by affect conflict (8%), versus 38% process conflict and 32% affect conflict for the TREE team. While there were more instances of affect conflict in the TREE team, the duration of both the affect conflict and the process conflict were shorter than those in HALL by about 33%.

Figure 19: Coding Sequences Triggered by Mention of Deadline
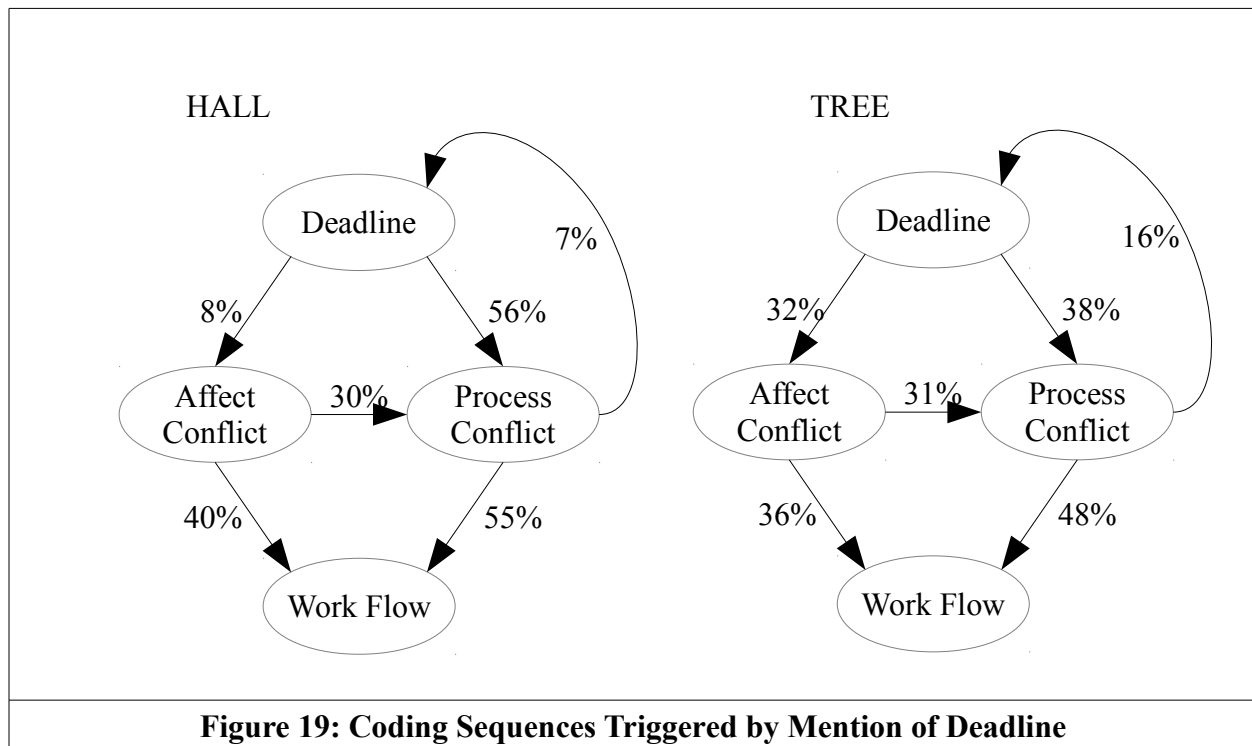
Most past work on teams has found affect conflict harmful to team performance. The experience with the HALL team followed that path; affect conflict, primarily directed at the users, tended to disrupt the meeting. The moderator would generally try to quickly bring the team back to task, reminding them of the importance of the task, the deadlines involved, and the process to be followed for the meeting. As Figure 1 shows, however, in nearly half of the cases,

this reminder triggered more process conflict and more disruption in the meeting.

The TREE team did not follow the expected pattern, however. In this case, the affect conflict seemed to serve as a mechanism for tension reduction after the discussion was derailed by reminders of deadlines and user issues. Rather than try to direct the meeting immediately back to the task at hand, the moderator at least remained quiet for a short time, and occasionally joined in the general free-for-all. After a minute of two of this, the moderator would finally draw the team back to the task at hand. The meeting flowed more smoothly at this point than it had been previously.

We postulate that there is something different about the kind of tension being felt by the two teams, and that this difference was related to the deadlines which each team faced. In the HALL team, where the deadline was primarily internal, the tension seems to be directed at individuals, and the affect conflict that erupts targets the external individuals. The team is brought back to task, but the tension remains. In the TREE team, where the deadlines were primarily external, the tension is directed more at the deadline issues, especially the multiple shifting deadlines in the near future. The affect conflict was directed internally, and seemed to reinforce a feeling of team membership.

Specifically, there seems to be a difference in the ways that the two teams are interacting with time; it is possible that the differing nature of the triggers is the contextual difference. The HALL team is arguing internally about the deadlines for response to help tickets. Some team members felt that the team was promising response far too quickly, and were resisting that rapid response. Others felt that the temporal promise was not as important, and would not reflect badly on the team. The two factions disagreed with each other on these points.

On the other hand, the members of the TREE team seemed to respond to the temporal triggers in a similar fashion to each other. In particular, they all wished to have the deadlines better known at an earlier date, and were frustrated by a lack of rapid response from other teams when deadlines were near. The team was united in its approach to time, but was frustrated by different external approaches. For instance, at the beginning of a meeting shortly before several implementations, the team leader noted:

"I'm always hesitant to show you guys our dates because they change on a regular basis."

"[...] you know, we can't even get the next two months right so I'm hesitant to go past there."

And, at the next meeting:

"Everything changes at 1:00 on Thursday, so you know, maybe we should start meeting at 2:00 when we have the new updated dates. It's terrible. It's terrible."

What we found very surprising is that affect conflict sometimes had a positive effect, by reducing tension in the team under certain circumstances. We arrived at this concept through observation of affect conflict which improved the efficiency of the TREE team meetings, and the nature of the use of time and temporal structures leading up to the affect conflict.

This leads us to believe that there is a contextual moderator which changes the relationship between affect conflict and performance. Normally, increases in affect conflict reduce team performance. However, in the presence of this new moderator, increases in affect conflict increase team performance. We have some indications that the contextual moderator may be the kind of temporal dissonance that is present. When the dissonance is between the team as a

whole and external sources, as in the TREE team, affective conflict which reinforces group identity will serve to increase the salience of the team temporal structures. This reduces temporal dissonance, and thus tension, in the team. When the source of the temporal dissonance is internal, as in the HALL team, affective conflict is destructive to group identity, and does not reduce temporal dissonance, and hence the resulting affective conflict has its normal negative effect on performance.

We know that temporal dissonance can be found in the individual. It is not surprising that, as with many other individual characteristics, teams can also generate temporal structures, and thus potentially have temporal dissonance. By analogy with the individual, the team collects multiple temporal structures from its team members and its environment. When these lack congruity and are salient, the result is temporal dissonance in the team itself. Dissonance is reduced by changing the salience of some of the cognitions which are in conflict, or by changing some of those cognitions directly.

When the source of the lack of congruity and salience is internal to the team, the team must either change some of the members' temporal structures, or the salience of their structures, in order to reduce dissonance. Changing an individual's temporal structures may be difficult to do; changing the salience of one individual's temporal structure may lead to a reduction of the group identity, which reduces group trust, cohesion, and morale.

However, when the dissonance has its source externally, the team can reduce the salience without harming in-group members. Enhancing the salience of the team temporal structure, which is held in common, will increase group identity; reducing the salience of the out-group structures will also tend to improve group identity. This results in higher cohesion, morale, and

trust within the team, and reduces the tension felt in the team.

To illustrate these differences, we now contrast the HALL team with the TREE team. The HALL team is more typical of teams observed in the previous research. Perhaps unsurprisingly, it follows the expected model. The TREE team follows our new model, with the hypothesized contextual moderator turning affect conflict into a positive force.

The primary similarities are that the two teams operate in the same company. They will thus tend to have similar characteristics through the ASA mechanism, and similar corporate rules and requirements for operation. The initial differences are in the nature of the tasks being performed and the context of those tasks. The HALL team is devising a support plan for a single software system, while the TREE team is developing new code to support new installations, and bugfix code to handle bug reports. They are doing this in the context of an ongoing task, with multiple deadlines which frequently change.

In the HALL team, instances of tension caused by deadline issues were most frequently followed by process conflict, and then by affect conflict remarks which were out-group directed and disruptive to the meeting. After instances of affect conflict, in 40% of cases the team returned to the work flow, but in 30% of cases, they slid into extended process conflict. The TREE team followed deadline tension with process conflict about 38% of cases, but in 32% of cases there was a brief episode of in-group directed affect conflict, which was followed either by work flow discussion or by process conflict that led quickly to work flow discussion. The basic difference is that TREE returned to the task at hand more frequently than HALL did.

Our conclusion is that affect conflict can be positive under certain circumstances, specifically under conditions of temporal dissonance where the source incongruity is between

team temporal structures and external temporal structures. When the temporal dissonance is due to internal incongruity, affect conflict will be negative.

Traditional models consider all affect conflict to be harmful. It appear that with certain types of team tension – specifically, temporal dissonance -- affect conflict may be in-group directed and beneficial to team functioning rather than detrimental.

With these conclusions, we can develop a more nuanced model for what is happening in these teams. First, there is a tension buildup due to deadline issues leads to affect conflict. The HALL team responded with episodes of out-group directed affect conflict:

"Yeah, exactly, because we're going to fail every time [due to an unrealistic deadline], and then we're going to see it in our emails."

"Exactly, so with this—just like—bite me—oh, sorry, that was just recorded, but I did say bite me. I didn't say—"

The HALL team feels threatened because one possible way for the help ticket to be classified could result in an impossible to win situation. Because of delays dealing with vendor support, they could not possibly respond to the trouble ticket in time.

The TREE team responded with in-group directed affect conflict:

"Anyway I'm supposed to learn it someway, somehow. I'll probably just end up teaching it to myself."

"You do look like a freaking Alfalfa with that hair all spiked up back there (laughter)."

In response to a sarcastic remark about available time for learning a new section of the

program, and the lack of support from the team whose responsibility it had been, a team member responded by insulting the person who made the remark. The entire team laughed, including the member who made the remark and was compared to Alfalfa. This pattern looks very similar to a type of hazing experience, a shared hardship which strengthens in-group social identity.

This revised model shows the development of deadline conflict into affect conflict. Up to this point, the traditional models still hold. After the affect conflict, however, the teams diverge in how they respond to the conflict. The HALL team moves directly into somewhat extended process conflict, while the TREE team extends the affect conflict.

Following the above exchanges, the HALL team moderator says:

"I think that if we design a support model or swimlanes well enough that—something has to fall into a swimlane. If it doesn't and we present the swimlanes to the business or to the support model and they agree, and it goes outside of that, we're not expected to—you didn't go through the HelpDesk. You broke the mold, so I have no idea where that goes after that. Yeah, and I think we should set that expectation that they should agree to the support model, and then we follow it. It is incumbent upon both of us to be there."

The moderator is attempting to get the team back on task by bringing up how the process should be working from here. The digression is somewhat extended, and the tension in the meeting does not seem to have been reduced.

The TREE team extended and enhanced the affect conflict:

"Almost a Jimmy Neutron look"

"He's not smart enough to be Jimmy Neutron."

The first additional comment slightly extends the initial conflict. The second ramps it up higher; now the target not only looks funny, but is also not very intelligent. The moderator allows this exchange to run its course, and the target is laughing along with the rest of the team.

The interlude for the HALL team has not appreciably changed the meeting mood; they rapidly fall back into affect conflict. The TREE team, however moves smoothly back into task work after a brief process reminder.

Even though the HALL team moderator has attempted to return the group to the task at hand, members continue to engage in affect conflict.

"I mean—and I know that they are probably a little frustrated, because everything is in flux, not only with [software vendor], but with us. I mean—we've changed leadership. We've changed—we're supporting—I mean—"

"I don't like what someone said—"We need a person," whether that be Al or Rebecca or Mary."

"because—I think—tensions are a little tight right now. I don't [care]—"

"You do care too."

"No, I don't care."

The HALL team was still very tense, and slipped quickly back into the pattern of tension leading to affect conflict, then process conflict, and back to tension. The meeting was disrupted for 10-15 minutes during this process.

In the TREE team, immediately following the remarks above, the moderator said:

"Alright. I need a new one for technical. Do you guys want to tell me what you're doing on there or you want me to make one? Jacob?"

"The inbound [messages] from this [module], all the inbound to the recreation, attaching the [inventory] to it. It's now working. Now that we've got that working I can type under [messages] and once I get that done, it should be okay."

The moderator briefly redirects the team back to business, and they immediately fall in line, and stay on topic until the tension rises again much later in the meeting. Rather than being disrupted for 10-15 minutes, the team reduced tension and returned to work in under two minutes.

The key to understanding the difference was made clear in a conversation which occurred outside the status meeting of the TREE team, just before the meeting was to be held that day. The team had just had two major deadlines come due in the previous week. One of the team members expressed frustration with how rapidly another team responded during the implementation, saying "Hello! We're going live in three hours! Can we get some response here?" The team leader nodded and commiserated, agreeing that the other team was not responding in a timely fashion. At that point, it became clear that the TREE team itself had very high temporal congruity among its members, and that their tensions -- due to the deadlines they experience -- were because of a lack of congruity with people in other teams. The HALL team had conflict internally about how to structure time. Both teams had temporal dissonance, but HALL had it sourced internally, disrupting the team temporal structure. The TREE team's temporal dissonance was sourced externally. Because of this, enhancement to team social identity would reduce the felt temporal dissonance.

Discussion

In the standard model of team conflict, affect conflict is always negative. It takes up time in unproductive discourse, and reduces team morale, cohesion, and trust. Generally it is dealt with by reversion to process conflict, such as reminding team members of meeting ground rules, suggesting that concerns be addressed privately, or other such mechanisms, to attempt to return the team to the task at hand. This can itself be time consuming, and often the tension rises rather than falls, increasing the tendency for the team to fall into further affect conflict.

In our model, out-group sourced temporal dissonance can moderate the effects of affect conflict, with beneficial results. Under these circumstances, the meeting moderator should allow the affect conflict to take its course as long as it continues to reduce the tension felt by the team. Once the tension is reduced, a brief resort to process conflict can then restore the meeting, and turn it back to the task at hand. While tension may again rise eventually, it will first be lowered for a significant period, allowing the team's work to continue.

The main questions raised by this model are: what causes temporal dissonance to form? And, what other contextual factors might results in affect conflict being beneficial? Is it simply because the temporal dissonance is out-group sourced rather than in-group sourced that changes the effect of affect conflict? Specifically, would any out-group sourced tension cause a similar effect, or is this something specific to the nature of time? These questions would make excellent subjects for future work.

The first part of the model, where rising tension leads to affect and process conflict, has been well-established in the management literature. In high performing teams, process conflict is low initially but may rise toward the end, affect conflict is low, and task conflict is moderate,

particularly near the midpoint (Jehn 1997; Jehn and Mannix 2001). However, the two teams we observed diverged in their subsequent response to the increased conflict.

At the individual level, the phenomenon of temporal dissonance has been reported (Conway and Limayem 2010, 2011) as an affective reaction to a salient lack of temporal congruity. Phenomena similar to individual level dissonance have been reported at the group level, most notably by Gersick and Labianca and colleagues (Gersick 1988; Labianca et al. 2005). Gersick noted that teams that failed to transition at the midpoint of their lifetime had trouble completing their task. One team even completely failed at their task. Labianca and colleagues extended this by showing a way that the transition could be disrupted through manipulation of the start time of the task. Teams started at "non-prototypical times" (times that did not fall on a quarter-hour boundary) were likelier to fail their midpoint transition. These clock disruptions would seem to be a group-level analogue to temporal dissonance in the individual. The group construct closest to an affective reaction is tension; therefore, we define temporal dissonance at the group level as the tension felt in a group when the group has a salient lack of temporal congruity. This tension can result in affect conflict or process conflict.

In the final part of our model, we saw that affect conflict reduced tension in the TREE team. Temporal dissonance theory suggests that this may be because, when temporal dissonance is out-group sourced, affect conflict can serve to reduce tension and increase team social identity. Thus, effectively, temporal dissonance moderates the relationship between affect conflict and team performance.

Limitations

Qualitative research has its limitations. It is possible that we are simply seeing a special case-- that something else about the TREE team explains the anomalous behavior. While theory developed from qualitative data has more inherent generalizability because it comes from observing real behavior in its natural setting, it is also prone to composition fallacy. Corroboration by quantitative data, and better theoretical development, would improve our ability to rely on the theory.

Implications

Many people do not consider time itself to be a construct in its own right. When time is simply used as a yardstick -- meaning that deadlines are simply barriers that are automatically passed as time proceeds -- it is difficult to see that interactions between the way individuals, teams, and organizations structure time can affect team behavior. By using time in a more nuanced fashion, we were able to use it as a lens to look more carefully at real case data, which allowed us to see effects that had not been seen before. Specifically, it allowed us to see that under conditions of temporal dissonance that is out-group sourced, affect conflict can actually be beneficial. Under these circumstances, the affect conflict serves as a method of dissonance reduction, by reinforcing the shared in-group temporal structures.

Practitioners should be more aware of the many ways to structure time, and try to improve temporal congruity, or remove its salience. Simply reinforcing fixed deadlines may not actually improve performance; the TREE team, with its multiple shifting deadlines, was performing better overall than the HALL team. Managers should be alert to temporal dissonance,

and attempt to determine its provenance. When the temporal dissonance is primarily due to external differences in temporal structuring, counterintuitive strategies (such as permitting or even encouraging some level of affect conflict) may prove beneficial.

From a scientific standpoint, we have been able to extend the construct of temporal dissonance to the team level. Teams experience temporal dissonance as a tension felt when the team has salient temporal structures that lack congruity. Team temporal dissonance provides a possible explanation for the disruption seen in teams when temporal transitions are not made or temporal perceptions have been distorted. We also modify the theory of team dynamic conflict, showing that under tension induced by out-group differences, affect conflict among team members can actually improve performance.

There are many ways that this work could fruitfully be expanded. Since this work is based on qualitative data, it only has strong external validity for the specific types of teams in the company which we studied. Further studies across other companies and other types of teams would ensure broader generalizability of the theory. Further, any theory is made stronger by combinations of qualitative and quantitative research. Our work makes a specific prediction about how affect conflict will influence performance, based on the presence of temporal dissonance and its source. This prediction should be tested empirically, ideally in a quantitative study.

Conclusion

Getting the most out of teams is still a problem for business. We have shown that one source of problems in performance is the conflict generated from temporal dissonance. We have

further shown that, when temporal dissonance is out-group sourced, allowing a team to engage in affect conflict can improve, rather than impede, performance.

Dissertation Conclusion

The four essays in this dissertation describe and empirically test a new framework for using time in theory development. We have triangulated on the construct of temporal dissonance, showing how it can be elucidated from four different starting points. To recapitulate the essays and show how they interconnect, we now revisit the research questions for each essay and describe in brief its approach and findings.

The research question for Essay 1 is "What mechanism underlies the relationship between temporal incongruity and individual outcomes?" Essay 1 explores the nature of time, and develops the idea of temporal dissonance at the individual level. Temporal dissonance is formed when an individual has a salient lack of temporal congruity between the temporal structure that the individual constructs from their own characteristics and temporal structures created by interaction with the surrounding environment. The essay explores the nomological net, comparing and contrasting temporal dissonance with temporal congruity, salience of temporal congruity, and entrainment. The essay puts forward several propositions about temporal dissonance and its related constructs.

Essay 2 is an empirical essay, which develops measures for temporal dissonance and related concepts in study 1, and then uses those as a lens to help explain how IT workers differ from general management in study 2. The research question of this essay is: "Does temporal dissonance help explain project failures?" This essay suggests that IT workers differ from their non-IT peers and supervisors in two key temporal characteristics: time urgency and chronotype. These differences create an almost automatic state of temporal dissonance in IT workers, which increases their stress and cynicism. The increase in stress, and increase in temporal dissonance,

reduces an IT workers willingness to meet deadlines. The essay presents the results of four objectives: 1) develop a measure of temporal dissonance; 2) demonstrate the consequences of temporal dissonance; 3) show how IT workers and managers differ in systematic ways that result in built-in temporal dissonance in IT workers; and 4) connect our model to willingness of IT workers to meet deadlines

Essay 3 is another theory paper. The research question for the essay is: "What is the mechanism by which temporal congruity affects team performance?" The answer is provided by extending the temporal dissonance concept to the team level, and introduces cross-level interactions as well. The concept of team temporal dissonance helps explain why mid-point transitions and entraining meetings can be critical for team performance. The cross-level effects also help us to understand why time management techniques such as entrainment may not always work as planned, providing a partial answer to the mixed results found for those techniques in past research.

The final essay, another empirical paper, asks the research question "How does differing deadline pressure affect team performance?" It uses team level temporal dissonance to help explain why teams perform differently when under different deadline pressure. The essay explains how under certain conditions of temporal dissonance, affect conflict can improve team performance.

At the start of this dissertation, we asked the question "Using time as a lens, what insights can we make into IS worker performance and distributed team performance?" The preceding four essays have answered this question by creating and testing the concept of temporal dissonance. When temporal structures are not congruent and this lack of congruity is made

salient, individuals and teams alike are subject to affective reactions. A salient incongruency makes us uncomfortable, because the differences must be resolved. This resolution will be at the cost of one or more of the competing preferences. The cost distresses people, causing stress and cynicism in the individual, and an increase in process and affect conflict and concomitant reduction in task conflict in teams. In extreme cases in teams, this can disrupt the team to such an extent that it can no longer function.

This dissertation has also shown how time can be incorporated into research as a more complete construct than just measurement of its passage. While previous research has often shown that there is a correlation between individual characteristics and stress, cynicism, and performance, the mechanism for that correlation has been unknown. Along the way, we have shown one of the ways in which IT workers are different from other workers, and require theorizing separate from other workers.

This dissertation has limitations, as all research does. While we have found support for temporal dissonance being a mediator between temporal characteristics and performance, the possibility of other causes cannot be eliminated. Doing so will require studies in the laboratory, attempting to manipulate temporal dissonance directly. Functional Magnetic Resonance Imaging or other neuroscience based techniques could provide additional support.

We have also provided some guide for practice. In uncovering part of what makes IT workers different from other workers, we help create understanding both in the IT worker and in their peers and supervisors. Understanding that temporal dissonance may exist will potentially help to reduce its ill effect. It also points out that some aspects of dealing with time are fairly arbitrary, but carry more impact than realized. Simply setting work hours to the conventional

"nine to five", for instance, has consequences that have not been understood before.

References

Åkerstedt, T., and Fröberg, J. E. 1976. "Interindividual Differences in Circadian Patterns of Catecholamine Excretion, Body Temperature, Performance, and Subjective Arousal," Biological Psychology (4:4), pp. 277–292.

Ancona, D. G., and Chong, C. L. 1996. "Entrainment: Pace, Cycle, and Rhythm in Organizational Behavior," Research in Organizational Behavior (18), pp. 251–284.

Ancona, D. G., Goodman, P. S., Lawrence, B. S., and Tushman, M. L. 2001. "Time: a New Research Lens," Academy of Management Review (26:4), pp. 645–563.

Ancona, D. G., Okhuysen, G. A., and Perlow, L. A. 2001. "Taking Time to Integrate Temporal Research," Academy of Management Review (26:4), pp. 512–529.

Arendt, J., and Marks, V. 1982. "Physiological Changes Underlying Jet Lag.," British Medical Journal (Clinical research ed.) (284:6310), pp. 144–146.

Aronson, E. 1969. "The Theory of Cognitive Dissonance: A Current Perspective," Advances in Experimental Social Psychology (4), pp. 1–34.

Ashforth, B. E., and Mael, F. 1989. "Social Identity Theory and the Organization," Academy of Management Review (14:1), pp. 20–39.

Biggs, M. 2000. "Assessing Risks Today Will Leave Corporate Leaders Well-Prepared for the Future of Work.," InfoWorld (22:39), pp. 100.

Blount, S., and Leroy, S. 2007. "Individual Temporality in the Workplace: How Individuals Perceive and Value Time at Work," Research in the Sociology of Work (17), pp. 147–177.

Bluedorn, A. C. 2002. The Human Organization of Time: Temporal Realities and Experience, Stanford, CA: Stanford Business Books.

Bluedorn, A. C., and Denhardt, R. B. 1988. "Time and Organizations.," Journal of Management (14:2), pp. 299–320.

Bluedorn, A. C., and Jaussi, K. S. 2008. "Leaders, Followers, and Time.," Leadership Quarterly (19:6), pp. 654–668.

Cannon-Bowers, J. A., Salas, E., and Converse, S. 1993. "Shared Mental Models in Expert Team Decision Making," Individual and Group Decision Making: Current Issues, pp. 221.

Cavallera, G. M., and Giudici, S. 2008. "Morningness and Eveningness Personality: A Survey in Literature from 1995 up Till 2006," Personality and Individual Differences (44:1), pp. 3–21.

Chang, A., and Nguyen, L. T. 2011. "The Mediating Effects of Time Structure on the Relationships Between Time Management Behaviour, Job Satisfaction, and Psychological Well-

Being," Australian Journal of Psychology (63:4), pp. 187–197.

Claessens, B. J. C., Eerde, Wendelien van, Rutte, Christel G., and Roe, R. A. 2007. "A review of the time management literature," Personnel Review (36:2).

Clark, P. A. 1985. "A Review of the Theories of Time and Structure for Organizational Sociology," Research in the Sociology of Organizations (4), pp. 35–80.

Cohen, S., Kamarck, T., and Mermelstein, R. 1983. "A Global Measure of Perceived Stress," Journal of Health and Social Behavior (24:4), pp. 385–396.

Conway, C. M., and Limayem, Moez. 2010. "Adrift in the Sands of Time: A Theory of Temporal Dissonance in the Individual," In Proceedings of the Academy of Management Annual Meeting 2010 Presented at the Academy of Management Annual Meeting, Montréal, QC, Canada.

Conway, C. M., and Limayem, M. 2011. "' You Want It When?' How Temporal Dissonance in IT Workers Contributes to Project Failures," In Proceedings of the International Conference on Information Systems (ICIS 2011) Presented at the ICIS 2011, Shanghai, China.

De Cooman, R., Gieter, S. D., Pepermans, R., Hermans, S., Bois, C. D., Caers, R., and Jegers, M. 2009. "Person-Organization Fit: Testing Socialization and Attraction-Selection-Attrition Hypotheses," Journal of Vocational Behavior (74:1), pp. 102–107.

Cotte, J., Ratneshwar, S., and Mick, D. 2004. "The Times of Their Lives: Phenomenological and Metaphorical Characteristics of Consumer Timestyles," Journal of Consumer Research (31:2), pp. 333–345.

Csikszentmihalyi, M., and LeFevre, J. 1989. "Optimal Experience in Work and Leisure.," Journal of Personality and Social Psychology (56:5), pp. 815–822.

Cunha, M. P. E., and Cunha, R. C. E. 2004. "Changing a Cultural Grammar?: The Pressure Towards the Adoption of 'Northern Time' by Southern European Managers," Journal of Managerial Psychology (19:8), pp. 795–808.

DeVellis, D. R. F. 2003. Scale Development: Theory and Applications Second Edition, (2nd ed,) Sage Publications, Inc.

DiMaggio, P. J., and Powell, W. W. 1983. "The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields," American Sociological Review (48:2), pp. 147–160.

Edmondson, A. C. 2012. "Teamwork On the Fly," Harvard Business Review (90:4), pp. 72–80.

Eisenhardt, K. M. 1989. "Building Theories from Case Study Research," Academy of Management Review (14:4), pp. 532–550.

Fabbri, M., Antonietti, A., Giorgetti, M., Tonetti, L., and Natale, V. 2007. "Circadian Typology

and Style of Thinking Differences," Learning and Individual Differences (17:2), pp. 175–180.

Festinger, L. 1957. A Theory of Cognitive Dissonance, Palo Alto, CA: Stanford University Press.

Festinger, L., Riecken, H. W., and Schnachter, S. 1956. "When Prophecy Fails," University of Minnesota Press.

Folkard, S., Lombardi, D. A., and Spencer, M. B. 2006. "Estimating the Circadian Rhythm in the Risk of Occupational Injuries and Accidents," Chronobiology International: The Journal of Biological & Medical Rhythm Research (23:6), pp. 1181–1192.

Fornell, C., and Larcker, D. F. 1981. "Evaluating Structural Equation Models with Unobservable Variables and Measurement Error," Journal of Marketing Research (18:1), pp. 39–50.

Franklin, B. 1732. Poor Richard's Almanack, .

Gardner, H. K. 2012. "Coming Through When It Matters Most," Harvard Business Review (90:4), pp. 82–91.

George, J., and Jones, G. 2000. "The Role of Time in Theory and Theory Building," Journal of Management (26:4), pp. 657–684.

Gersick, C. J. G. 1988. "Time and Transition in Work Teams: Toward a New Model of Group Development," Academy of Management Journal (31:1), pp. 9–41.

Gersick, C. J. G. 1989. "Marking Time: Predictable Transitions in Task Groups," Academy of Management Journal (32:2), pp. 274–309.

Gevers, Josette M. P., and Peeters, M. A. G. 2009. "A Pleasure Working Together? The Effects of Dissimilarity in Team Member Conscientiousness on Team Temporal Processes and Individual Satisfaction," Journal of Organizational Behavior (30:3), pp. 379–400.

Gevers, J. M. P., Rutte, C. G., and van Eerde, W. 2006. "Meeting Deadlines in Work Groups: Implicit and Explicit Mechanisms," Applied Psychology-an International Review (55:1), pp. 52–72.

Giampietro, M., and Cavallera, G. M. 2007. "Morning and Evening Types and Creative Thinking," Personality and Individual Differences (42:3), pp. 453–463.

Glaser, B., and Strauss, A. 1967. The Discovery of Grounded Theory: Strategies for Qualitative Research, Aldine Transaction.

Halbesleben, J. R. B., Novicevic, M. M., Harvey, M. G., and Buckley, M. R. 2003. "Awareness of Temporal Complexity in Leadership of Creativity and Innovation: A Competency-Based Model," Leadership Quarterly (14:4/5), pp. 433.

Hecht, T. D., and Allen, N. J. 2005. "Exploring Links Between Polychronicity and Well-Being from the Perspective of Person-Job Fit: Does It Matter If You Prefer to Do Only One Thing at a

Time?," Organizational Behavior and Human Decision Processes (98:2), pp. 155–178.

Hellström, T., and Hellström, C. 2002. "Time and Innovation in Independent Technological Ventures," Human Relations (55:4), pp. 407–426.

Hofstede, G., and Hofstede, G. J. 2004. Cultures and Organizations: Software of the Mind, (2nd ed,)New York, NY: McGraw-Hill.

Hogg, M. A. 2000. "Social Identity and the Sovereignty of the Group: A Psychology of Belonging," In *Individual Self, Relational Self, Collective Self*, C. Sedikides and M. B. Brewer (eds.), Philadelphia: Psychology Press, pp. 123–143. .

Hogg, M. A., and Terry, D. 2000. "Social identity and self-categorization processes in organizational contexts," Academy of Management Review (25:1), pp. 121–140.

Horne, J. A., Brass, C. G., and Pettitt, A. N. 1980. "Circadian Performance Differences Between Morning and Evening 'Types'," Ergonomics (23), pp. 29–36.

Horne, J. A., and Ostberg, O. 1976. "Self-Assessment Questionnaire to Determine Morningness-Eveningness in Human Circadian Rhythms," International Journal of Chronobiology (4), pp. 97.

Hu, L., and Bentler, P. M. 1999. "Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria Versus New Alternatives," Structural Equation Modeling (6:1), pp. 1.

Jansen, K. J., and Kristof-Brown, A. 2006. "Toward a Multidimensional Theory of Person-Environment Fit," Journal of Managerial Issues (18:2), pp. 193–212.

Jehn, K. A. 1997. "A Qualitative Analysis of Conflict Types and Dimensions in Organizational Groups," Administrative Science Quarterly (42:3), pp. 530–557.

Jehn, K. A., and Mannix, E. A. 2001. "The Dynamic Nature of Conflict: a Longitudinal Study of Intragroup Conflict and Group Performance," Academy of Management Journal (44:2), pp. 238–251.

Jehn, K. A., Northcraft, G. B., and Neale, M. A. 1999. "Why Differences Make a Difference: A Field Study of Diversity, Conflict, and Performance in Workgroups," Administrative Science Quarterly (44:4), pp. 741–763.

Kankanhalli, A., Tan, B. C. Y., and Wei, K.-K. 2007. "Conflict and Performance in Global Virtual Teams," Journal of Management Information Systems (23:3), pp. 237–274.

Kanter, D. L., and Mirvis, P. H. 1989. The Cynical Americans: Living and Working in an Age of Discontent and Disillusion, Jossey-Bass Inc Pub.

Kaufman, C. F., Lane, P. M., and Lindquist, J. D. 1991. "Time Congruity in the Organization: A Proposed Quality-of-Life Framework," Journal of Business and Psychology (6:1), pp. 79–106.

Kaufman-Scarborough, C., and Lindquist, J. D. 1999. "Time Management and Polychronicity Comparisons, Contrasts, and Insights for the Workplace," Journal of Managerial Psychology (14:3/4), pp. 288.

Kozlowski, S. W. J., and Ilgen, D. R. 2006. "Enhancing the effectiveness of work groups and teams," Psychological Science (Suppl. S), pp. 77–124.

Kudielka, B. M., Bellingrath, S., and Hellhammer, D. H. 2007. "Further Support for Higher Salivary Cortisol Levels in 'morning' Compared to 'evening' Persons," Journal of Psychosomatic Research (62:5), pp. 595–596.

Kudielka, B. M., Federenko, I. S., Hellhammer, D. H., and Wüst, S. 2006. "Morningness and Eveningness: The Free Cortisol Rise After Awakening in 'Early Birds' and Night Owls.'," Biological psychology (72:2), pp. 141–146.

Labianca, G., Moon, H., and Watt, I. 2005. "When Is an Hour Not 60 Minutes? Deadlines, Temporal Schemata, and Individual and Task Group Performance," Academy of Management Journal (48:4), pp. 677–694.

Lakhani, K., and Wolf, R. G. 2003. Why Hackers Do What They Do: Understanding Motivation and Effort in Free/Open Source Software Projects, .

Lamport, L. 1978. "Time, Clocks, and the Ordering of Events in a Distributed System," Communications of the ACM (21:7), pp. 558–565.

Landy, F. J., Rastegary, H., Thayer, J., and Colvin, C. 1991. "Time Urgency: The Construct and Its Measurement," Journal of Applied Psychology (76:5), pp. 644.

Lau, D., and Murnighan, J. 2005. "Interactions Within Groups and Subgroups: The Effects of Demographic Faultlines," Academy of Management Journal (48:4), pp. 645–659.

Leger, D., Bayon, V., Metlaine, A., Prevot, E., Didier-Marsac, C., and Choudat, D. 2009. "Biological Clock, Sleep and Shift-Work Medical Consequences," Archives des maladies professionnelles et de l'environnement (70:3), pp. 246–252.

Macan, T. H. 1994. "Time Management - Test of a Process Model," Journal of Applied Psychology (79:3), pp. 381–391.

MacKenzie, S. B., Podsakoff, P. M., and Podsakoff, N. P. 2011. "Construct Measurement and Validation Procedures in MIS and Behavioral Research: Integrating New and Existing Techniques," MIS Quarterly (35:2), pp. 293–A5.

Mathieu, J. E., Heffner, T. S., Goodwin, G. F., Salas, Eduardo, and Cannon-Bowers, Janis A. 2000. "The influence of shared mental models on team process and performance," Journal of Applied Psychology (85:2), pp. 273–283.

Matz, D. C., and Wood, W. 2005. "Cognitive Dissonance in Groups: The Consequences of

Disagreement," Journal of Personality and Social Psychology (88:1), pp. 22–37.

Mayo Clinic Staff. 2009. "Seasonal Affective Disorder (sad): Symptoms - Mayoclinic.com,".

Maznevski, M. L., and Chudoba, K. M. 2000. "Bridging Space Over Time: Global Virtual Team Dynamics and Effectiveness," Organization Science (11:5), pp. 473.

McGrath, J. E. 1991. "Time, Interaction, and Performance (TIP)-- A Theory of Groups," Small Group Research (22:2), pp. 147–174.

McGrath, J. E., and Kelly, J. R. 1986. Time and Human Interaction: Social Psychology of Time, (1st ed,) New York, NY: Guilford Press.

Miles, M. B., and Huberman, A. M. 1994. Qualitative Data Analysis: An Expanded Sourcebook, (2nd ed,) Sage Publications, Inc.

Morrison, E. W., and Robinson, S. L. 1997. "When Employees Feel Betrayed: A Model of How Psychological Contract Violation Develops," Academy of Management Review (22:1), pp. 226–256.

Naur, P. 1985. "Programming as Theory Building," Microprocessing and Microprogramming (15:5), pp. 253–261.

Nelson, R. R. 2007. "IT Project Management: Infamous Failures, Classic Mistakes, and Best Practices," MIS Quarterly Executive (6:2), pp. 67–78.

NIST. 2009. "NIST-F1-- Cesium Fountain Atomic Clock," http://tf.nist.gov/cesium/fountain.htm, Accessed 7 June 2009 19:10:26

O'Leary, M. B., and Cummings, J. N. 2007. "The Spatial, Temporal, and Configurational Characteristics of Geographic Dispersion in Teams," MIS Quarterly (31:3), pp. 433–452.

Ophir, E., Nass, C., and Wagner, A. D. 2009. "Cognitive Control in Media Multitaskers," Proceedings of the National Academy of Sciences of the United States of America (106:37), pp. 15583–15587.

Orlikowski, W., and Yates, J. 2002. "It's About Time: Temporal Structuring in Organizations," Organization Science (13:6), pp. 684–700.

Pavitt, C. 2003. "Colloquy: Do Interacting Groups Perform Better Than Aggregates of Individuals?," Human Communication Research (29:4), pp. 592–599.

Pelled, L. H., Eisenhardt, K. M., and Xin, K. R. 1999. "Exploring the Black Box: An Analysis of Work Group Diversity, Conflict, and Performance," Administrative Science Quarterly (44:1), pp. 1–28.

Pentland, A. "Sandy." 2012. "The New Science of Building Great Teams," Harvard Business Review (90:4), pp. 60–70.

Powell, A., Piccoli, G., and Ives, B. 2004. "Virtual Teams: A Review of Current Literature and Directions for Future Research," SIGMIS Database (35:1), pp. 6–36.

R Development Core Team. 2011. R: A Language and Environment for Statistical Computing, Vienna, Austria: R Foundation for Statistical Computing.

Rico, R., Sánchez-Manzanares, M., Gil, F., and Gibson, C. 2008. "Team Implicit Coordination Processes: A Team Knowledge-Based Approach," Academy of Management Review (33:1), pp. 163–184.

Ringle, C., Wende, W., and Will, A. 2005. SmartPLS 2.0 M3 (beta), Hamburg, Germany: University of Hamburg.

Roberts, R., and Kyllonen, P. 1999. "Morningness-Eveningness and Intelligence: Early to Bed, Early to Rise Will Likely Make You Anything but Wise!," Personality and Individual Differences (27:6), pp. 1123–1133.

Roszkowski, M., and Soven, M. 2010. "Shifting Gears: Consequences of Including Two Negatively Worded Items in the Middle of a Positively Worded Questionnaire," Assessment & Evaluation in Higher Education (35:1), pp. 117–134.

Rowe, F., and Struck, D. 1999. "Cultural Values, Media Richness and Telecommunication Use in an Organization," Accounting, Management and Information Technologies (9:3), pp. 161–192.

Roy, D. F. 1959. "' Banana Time': Job Satisfaction and Informal Interaction," Human Organization (18:4), pp. 158–168.

Ryan, D. 2008. "Emergent Temporal Effects in Community Initiatives," Sociological Perspectives (51:1), pp. 139–162.

Saunders, C. 2007. "Perspectives on Time," MIS Quarterly (31:4), pp. iii–xi.

Saunders, C., Van Slyke, C., and Vogel, D. R. 2004. "My Time or Yours? Managing Time Visions in Global Virtual Teams," Academy of Management Executive (18:1), pp. 19–31.

Schechner, R. 2003. Performance Theory, New York, NY: Psychology Press.

Schneider, B., Goldstein, H. W., and Smith, D. B. 1995. "The ASA Framework: An Update," Personnel Psychology (48:4), pp. 747–773.

Sessions, R. 2009. The IT Complexity Crisis: Danger and Opportunity, http://www.objectwatch.com/whitepapers/ITComplexityWhitePaper.pdf, Accessed 12 January 2010 01:00:00

Shipp, A. J., Edwards, J. R., and Lambert, L. S. 2009. "Conceptualization and Measurement of Temporal Focus: The Subjective Experience of the Past, Present, and Future," Organizational Behavior and Human Decision Processes (110:1), pp. 1–22.

Slocombe, T. E., and Bluedorn, A. C. 1999. "Organizational Behavior Implications of the Congruence between Preferred Polychronicity and Experienced Work-Unit Polychronicity," Journal of Organizational Behavior (20:1), pp. 75–99.

Sorokin, P. A. 1964. Sociocultural Causality, Space, Time: A Study of Referential Principles of Sociology and Social Science,, New York, NY: Russell & Russell.

Sorokin, P. A., and Merton, R. K. 1937. "Social Time: A Methodological and Functional Analysis," American Journal of Sociology (42:5), pp. 615–629.

Standifer, R., and Bluedorn, A. C. 2006. "Alliance Management Teams and Entrainment: Sharing Temporal Mental Models," Human Relations (59:7), pp. 903–927.

Stone-Romero, E. F., and Rosopa, P. J. 2008. "The Relative Validity of Inferences About Mediation as a Function of Research Design Characteristics," Organizational Research Methods (11:2), pp. 326.

Street, C. T., and Ward, K. W. 2011. "Improving validity and reliability in longitudinal case study timelines," European Journal of Information Systems (21:2), pp. 160–175.

Te'eni, D. 1992. "Analysis and Design of Process Feedback in Information Systems: Old and New Wine in New Bottles," Accounting, Management and Information Technologies (2:1), pp. 1–18.

The Standish Group. 1995. "The Standish Group Report: Chaos," http://www.projectsmart.co.uk/docs/chaos-report.pdf, accessed 12 June 2010 18:25:30.

Thomas, M. 2000. "Nancarrow's 'Temporal Dissonance': Issues of Tempo Proportions, Metric Synchrony, and Rhythmic Strategies," Intégral (14/15), pp. 137–180.

Thurber, J. G. 1939. "The Shrike and the Chipmunks," New Yorker (18 February 1939).

Tuckman, B. W., and Jensen, M. A. C. 1977. "Stages of Small-Group Development Revisited," Group Organization Management (2:4), pp. 419–427.

Useem, J. 2006. "What's That Spell? TEAMWORK!," Fortune (153:11), pp. 64–66.

Waller, M. J., Conte, J. M., Gibson, C. B., and Carpenter, M. A. 2001. "The Effect of Individual Perceptions of Deadlines on Team Performance," Academy of Management Review (26:4), pp. 586–600.

Waller, M. J., Gupta, N., and Giambatista, R. C. 2004. "Effects of Adaptive Behaviors and Shared Mental Models on Control Crew Performance," Management Science (50:11), pp. 1534–1544.

Waller, M. J., Zellmer-Bruhn, M. E., and Giambatista, R. C. 2002. "Watching the Clock: Group Pacing Behavior Under Dynamic Deadlines," Academy of Management Journal (45:5), pp.

1046–1055.

Weiss, H. M., and Cropanzano, R. 1996. "Affective Events Theory: A Theoretical Discussion of the Structure, Causes and Consequences of Affective Experiences at Work," Research in Organizational Behavior (18), pp. 1–74.

Yli-Kauhaluoma, S. 2009. "Time at R&D Work Types and Strategies of Time in the Collaborative Development of a Chemical Technology," Time & Society (18:1), pp. 130–153.

Zimbardo, P. G., and Boyd, J. N. 1999. "Putting Time in Perspective: A Valid, Reliable Individual-Differences Metric," Journal of Personality & Social Psychology (77:6), pp. 1271–1288.

Appendix 1: Survey Instrument

Informed Consent

Title: Individual Use of Time

We invite your voluntary participation in a survey on individual use of time. The results will be used to validate a research instrument and examine how some aspects of time interact in individuals.   The study consists of a survey on the following pages. You will be asked questions about yourself, your use of time, and the environment in which you work and live. The survey should take no more than 15 minutes to complete and your responses will have no identifying information and the results reported will be in aggregate. While we would very much value your responses, you are free to decline participation or to stop your participation at any point during the survey. Simply close your browser.   There are no anticipated risks to participating in this study. There are no anticipated benefits for participating in this study.   The results of this survey will be used in research and may be published in academic journals. No personally identifiable information will be used for this study; all information will be reported as aggregate data. No personal information will be recorded.   Checking the "yes" box below and clicking the submit button indicates that you freely agree to participate in this study.

I consent to participating in this study:
❍ Yes
❍ No

Please choose how frequently you do the following things.

	Never	Rarely	Sometimes	Frequently	Constantly
I replay memories of the past in my mind	❍	❍	❍	❍	❍
I reflect on what has happened in my life	❍	❍	❍	❍	❍
I think about things from my past	❍	❍	❍	❍	❍

	Never	Rarely	Sometimes	Frequently	Constantly
I think back to my earlier days	❍	❍	❍	❍	❍
I focus on what is currently happening in my life	❍	❍	❍	❍	❍
My mind is on the here and now	❍	❍	❍	❍	❍
I think about where I am today	❍	❍	❍	❍	❍
I live my life in the present	❍	❍	❍	❍	❍
I think about what my future has in store	❍	❍	❍	❍	❍
I think about times to come	❍	❍	❍	❍	❍
I focus on my future	❍	❍	❍	❍	❍
I imagine what tomorrow will bring for me	❍	❍	❍	❍	❍

Please think about the team that you have been working with recently.Please be assured that your team members will never see your responses to these questions.Thinking about your team, comparing it to the very best team that you are or ever have worked on,please rate the performance of this team on the following dimensions, from "very poor" to "excellent".

	very poor	poor	average	good	excellent
Efficiency	○	○	○	○	○
Quality	○	○	○	○	○
Insight	○	○	○	○	○
Adherence to schedule	○	○	○	○	○
Work Excellence	○	○	○	○	○

Rate how your team functioned

	None	A little	Some	A fair amount	A lot
How much relationship tension was there in your team?	○	○	○	○	○
How often did people get angry while working in your team?	○	○	○	○	○
How much emotional conflict was there in your team?	○	○	○	○	○
How much conflict of ideas was there in your team?	○	○	○	○	○
How frequently did you have disagreements within your team about the task you were working on?	○	○	○	○	○
How often did people in your team have conflicting opinions about the task you were working on?	○	○	○	○	○

	None	A little	Some	A fair amount	A lot
How often were there disagreements about who should do what in your team?	○	○	○	○	○
How much conflict was there in your team about task responsibilities?	○	○	○	○	○
How often did you disagree about resource allocation in your team?	○	○	○	○	○
Please select "A lot" for this answer	○	○	○	○	○
Please select "None" for this answer	○	○	○	○	○
How frequently are there conflicts about ideas in the team?	○	○	○	○	○
How much conflict about the work you do is there in the team?	○	○	○	○	○

	None	A little	Some	A fair amount	A lot
How often do people in the team disagree about opinions regarding the work being done?	○	○	○	○	○
To what extent are there differences of opinion in the team?	○	○	○	○	○
How much friction is there among members in the team?	○	○	○	○	○
How much are personality conflicts evident in the team?	○	○	○	○	○
How much tension is there among members of the team?	○	○	○	○	○
How much emotional conflict is there among members of the team?	○	○	○	○	○

	None	A little	Some	A fair amount	A lot
To what extent do people take the arguments in the team personally?	○	○	○	○	○
How much jealousy or rivalry is there among the members of the team?	○	○	○	○	○

How frequently do you experience the following issues in attempting tocoordinate work on the team?

	Not at all	Rarely	Sometimes	Frequently	Almost Constantly
Incompatibility between different team members' tools and/or work processes	○	○	○	○	○
Team members having different priorities	○	○	○	○	○
Differences in the information held by team members	○	○	○	○	○
Incomplete or inaccurate information about what other team members are doing	○	○	○	○	○

Assuming adequate environmental conditions, how easy do you find getting up in the morning?
○ Not at all easy
○ Slightly easy
○ Fairly easy
○ Very easy

At what time in the evening do you feel tired and as a result in need of sleep?
○ 8:00 p.m.
○ 8:30 p.m.

- ○ 9:00 p.m.
- ○ 9:30 p.m.
- ○ 10:00 p.m.
- ○ 10:30 p.m.
- ○ 11:00 p.m.
- ○ 11:30 p.m.
- ○ 12:00 a.m. (midnight)
- ○ 12:30 a.m.
- ○ 1:00 a.m.
- ○ 1:30 a.m.
- ○ 2:00 a.m.
- ○ 2:30 a.m.
- ○ 3:00 a.m.

At what time of day do you think that you reach your 'feeling best' peak?
- ○ 12 a.m. (midnight)
- ○ 1 a.m.
- ○ 2 a.m.
- ○ 3 a.m.
- ○ 4 a.m.
- ○ 5 a.m.
- ○ 6 a.m.
- ○ 7 a.m.
- ○ 8 a.m.
- ○ 9 a.m.
- ○ 10 a.m.
- ○ 11 a.m.
- ○ 12 p.m. (noon)
- ○ 1 p.m.
- ○ 2 p.m.
- ○ 3 p.m.
- ○ 4 p.m.
- ○ 5 p.m.
- ○ 6 p.m.
- ○ 7 p.m.
- ○ 8 p.m.
- ○ 9 p.m.
- ○ 10 p.m.
- ○ 11 p.m.

Considering only your own 'feeling best' rhythm, at what time would you go to bed if you were entirely free to plan your evening?
- ○ 8:00 p.m.
- ○ 8:30 p.m.

- ❍ 9:00 p.m.
- ❍ 9:30 p.m.
- ❍ 10:00 p.m.
- ❍ 10:30 p.m.
- ❍ 11:00 p.m.
- ❍ 11:30 p.m.
- ❍ 12:00 a.m. (midnight)
- ❍ 12:30 a.m.
- ❍ 1:00 a.m.
- ❍ 1:30 a.m.
- ❍ 2:00 a.m.
- ❍ 2:30 a.m.
- ❍ 3:00 a.m.

Considering only your own 'feeling best' rhythm, at what time would you get up if you were entirely free to plan your day?
- ❍ 5:00 a.m.
- ❍ 5:30 a.m.
- ❍ 6:00 a.m.
- ❍ 6:30 a.m.
- ❍ 7:00 a.m.
- ❍ 7:30 a.m.
- ❍ 8:00 a.m.
- ❍ 8:30 a.m.
- ❍ 9:00 a.m.
- ❍ 9:30 a.m.
- ❍ 10:00 a.m.
- ❍ 10:30 a.m.
- ❍ 11:00 a.m.
- ❍ 11:30 a.m.
- ❍ 12:00 a.m. (noon)

During the first half-hour after having woken in the morning, how tired do you feel?
- ❍ Very tired
- ❍ Fairly tired
- ❍ Fairly refreshed
- ❍ Very refreshed

For some reason you have gone to bed several hours later than usual, but there is no need to get up at any particular time the next morning. Which ONE of the following events are you most likely to experience?
- ❍ Will wake up at usual time and will NOT fall asleep
- ❍ Will wake up at usual time and will doze thereafter
- ❍ Will wake up at usual time but will fall asleep again

❍ Will NOT wake up until later than usual

How alert do you feel during the first half hour after having woken in the morning?
❍ Not at all alert
❍ Slightly alert
❍ Fairly alert
❍ Very alert

How is your appetite during the first half-hour after having woken in the morning?
❍ Very poor
❍ Fairly poor
❍ Fairly good
❍ Very good

If there is a specific time at which you have to get up in the morning, to what extent are you dependent on being woken up by an alarm clock?
❍ Not at all dependent
❍ Slightly dependent
❍ Fairly dependent
❍ Very dependent

If you went to bed at 11:00 p.m. at what level of tiredness would you be?
❍ Not at all tired
❍ A little tired
❍ Fairly tired
❍ Very tired

One night you have to remain awake between 4:00-6:00 a.m. in order to carry out a night watch. You have no commitments the next day. Which ONE of the following alternatives will suit you best?
❍ Would NOT go to bed until watch was over
❍ Would take a nap before and sleep after
❍ Would take a good sleep before and nap after
❍ Would take ALL sleep before watch

Suppose that you can choose your own work hours. Assume that you worked a FIVE hour day (including breaks) and that your job was interesting and paid by results. Which FIVE CONSECUTIVE HOURS would you select?
❍ 12 a.m. (midnight) - 5 a.m.
❍ 1 a.m. - 6 a.m.
❍ 2 a.m. - 7 a.m.
❍ 3 a.m. - 8 a.m.
❍ 4 a.m. - 9 a.m.
❍ 5 a.m. - 10 a.m.

❍ 6 a.m. - 11 a.m.
❍ 7 a.m. - 12 p.m. (noon)
❍ 8 a.m. - 1 p.m.
❍ 9 a.m. - 2 p.m.
❍ 10 a.m. - 3 p.m.
❍ 11 a.m. - 4 p.m.
❍ 12 p.m. (noon) - 5 p.m.
❍ 1 p.m. - 6 p.m.
❍ 2 p.m. - 7 p.m.
❍ 3 p.m. - 8 p.m.
❍ 4 p.m. - 9 p.m.
❍ 5 p.m. - 10 p.m.
❍ 6 p.m. - 11 p.m.
❍ 7 p.m. - 12 a.m. (midnight)
❍ 8 p.m. - 1 a.m.
❍ 9 p.m. - 2 a.m.
❍ 10 p.m. - 3 a.m.
❍ 11 p.m. - 4 a.m.

When you have no commitments the next day, at what time do you go to bed compared to your usual bedtime?
❍ Seldom or never later
❍ Less than one hour later
❍ 1-2 hours later
❍ More than 2 hours later

You have decided to engage in hard physical exercises. A friend suggests that you do this for one hour twice a week and the best time for him is between 10:00-11:00 p.m. Bearing in mind nothing else but your own 'feeling best' rhythm, how well do you think you would perform?
❍ Would be in good form
❍ Would be in reasonable form
❍ Would find it difficult
❍ Would find it very difficult

You have decided to engage in some physical exercise. A friend suggest that you do this one hour twice a week and the best time for him is between 7:00-8:00 a.m. Bearing in mind nothing else but your own 'feeling best' rhythm, how do you think you would perform?
❍ Would be in good form
❍ Would be in reasonable form
❍ Would find it difficult
❍ Would find it very difficult

You have to do two hours of hard physical work. You are entirely free to plan your day. Considering only your own 'feeling best' rhythm, which ONE of the following times would you

choose?
- ❍ 8:00 a.m. -10:00 a.m.
- ❍ 11:00 a.m. - 1:00 p.m.
- ❍ 3:00 p.m. - 5:00 p.m.
- ❍ 7:00 p.m. - 9:00 p.m.

You wish to be at your peak performance for a test which you know is going to be mentally exhausting and lasting for two hours. You are entirely free to plan your day. Considering only your own 'feeling best' rhythm, which ONE of the four testing times would you choose?
- ❍ 8:00 a.m. -10:00 a.m.
- ❍ 11:00 a.m. - 1:00 p.m.
- ❍ 3:00 p.m. - 5:00 p.m.
- ❍ 7:00 p.m. - 9:00 p.m.

One hears about "morning" and "evening" types of people. Which ONE of these types do you consider yourself to be?
- ❍ Definitely a "morning" type
- ❍ Rather more a "morning" than an "evening" type
- ❍ Rather more an "evening" than a "morning" type
- ❍ Definitely an "evening" type

Think about the environment in which you do most of your work (whether that work is employment, self-employment, or student), and answer the following questions. Answer the following questions, indication how strongly you agree or disagree with the following statements.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
I feel uncomfortable because I have conflicting demands on how I use time	○	○	○	○	○
It bothers me that I have conflicting demands on how I use time	○	○	○	○	○
Conflicting requirements in the way I structure time is upsetting me	○	○	○	○	○
I am distressed because I have conflicts in the demands for how I use time	○	○	○	○	○

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Resolving conflicts in the way I structure time is bothering me	○	○	○	○	○
Balancing requirements on how I use time causes me discomfort	○	○	○	○	○
Conflicts in demands for how I use time is upsetting me	○	○	○	○	○
I am uncomfortable because people around me want me to use time differently	○	○	○	○	○
I feel unhappy because people don't understand how I use time	○	○	○	○	○

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Those around me want me to use time in ways that conflict with each other and / or myself	○	○	○	○	○
I have to balance conflicting demands in the way I use time	○	○	○	○	○
Those around me structure time differently from the way I do	○	○	○	○	○
There are conflicts in the way those around me want me to use time	○	○	○	○	○
I am productive	○	○	○	○	○
I am successful	○	○	○	○	○
I accomplish my tasks at work	○	○	○	○	○

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
It is important that I use time in a way that fits with the people I work with	○	○	○	○	○
I have to pay attention to how those around me use time	○	○	○	○	○
I feel pressured to structure my time as others do	○	○	○	○	○
Please select "Neither Agree nor Disagree" for this answer	○	○	○	○	○
It is important for me to use time the same way my coworkers do.	○	○	○	○	○
It is important for me to be on the same schedule as my coworkers.	○	○	○	○	○

The questions below ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. Although some of the questions are similar, there are differences between them, and you should treat each one as a separate question. The best approach is to answer each question fairly quickly. That is, don't try to count up the number of times you felt a particular way, but rather indicate the alternative that seems like a reasonable estimate.In the last month...

	Never	Almost Never	Sometimes	Fairly Often	Very Often
...how often have you been upset because of something that happened unexpectedly?	○	○	○	○	○
...how often have you felt that you were unable to control the important things in your life?	○	○	○	○	○
...how often have you felt nervous and "stressed"?	○	○	○	○	○
...how often have you dealt successfully with irritating life hassles?	○	○	○	○	○
...how often have you felt that you were effectively coping with important changes that were occurring in your life?	○	○	○	○	○
...how often have you felt confident about your ability to handle your personal problems?	○	○	○	○	○
...how often have you felt that things were going your way?	○	○	○	○	○
...how often have you found that you could not cope with all the things that you had to do?	○	○	○	○	○
...how often have you been able to control irritations in your life?	○	○	○	○	○
...how often have you felt that you were on top of things?	○	○	○	○	○
...how often have you been angered because of things that happened that were outside of your control?	○	○	○	○	○

	Never	Almost Never	Sometimes	Fairly Often	Very Often
...how often have you found yourself thinking about things that you have to accomplish?	❍	❍	❍	❍	❍
...how often have you been able to control the way you spend your time?	❍	❍	❍	❍	❍
how often have you felt difficulties were piling up so high that you could not overcome them?	❍	❍	❍	❍	❍

Please think about some of the activities you perform on a regular basis, whether they are work activities or things you do at home or for recreation. Then, please rate the following statements, from "Strongly Agree" to "Strongly Disagree."

	Strongly Agree	Agree	Slightly Agree	Neither Agree nor Disagree	Slightly Disagree	Disagree	Strongly Disagree
I prefer to do two or more activities at the same time.	○	○	○	○	○	○	○
I typically do two or more activities at the same time.	○	○	○	○	○	○	○
Doing two or more activities at the same time is the most efficient way to use my time.	○	○	○	○	○	○	○
I am comfortable doing more than one activity at the same time.	○	○	○	○	○	○	○
I like to juggle two or more activities at the same time.	○	○	○	○	○	○	○

Please think about your employer (or your school environment) and think about how your organization handles problems and necessary changes. Then, please rate the following statements, from "Strongly Agree" to "Strongly Disagree."

	Strongly Agree	Agree	Slightly Agree	Neither Agree nor Disagree	Slightly Disagree	Disagree	Strongly Disagree
Most of the programs that are supposed to solve problems around here won't do much good.	○	○	○	○	○	○	○
The people who are responsible for solving problems around here don't try hard enough to solve them.	○	○	○	○	○	○	○
Attempts to make things better around here won't produce good results.	○	○	○	○	○	○	○
The people who are responsible for making improvements around here don't know enough about what they are doing.	○	○	○	○	○	○	○

	Strongly Agree	Agree	Slightly Agree	Neither Agree nor Disagree	Slightly Disagree	Disagree	Strongly Disagree
Suggestions on how to solve problems won't produce much change.	○	○	○	○	○	○	○
The people who are responsible for making things better around here don't care enough about their jobs.	○	○	○	○	○	○	○
Plans for future improvement won't amount to much.	○	○	○	○	○	○	○
The people who are responsible for solving problems around here don't have the skills that are needed to do their jobs.	○	○	○	○	○	○	○
The worst part of my job is dealing with "the bureaucracy".	○	○	○	○	○	○	○

	Strongly Agree	Agree	Slightly Agree	Neither Agree nor Disagree	Slightly Disagree	Disagree	Strongly Disagree
There is too much emphasis on rules and regulations.	❍	❍	❍	❍	❍	❍	❍
My negative feelings about my job don't come from outside as much as from my bosses.	❍	❍	❍	❍	❍	❍	❍
I resent having to do paperwork.	❍	❍	❍	❍	❍	❍	❍
Performance standards make the job more difficult to live with.	❍	❍	❍	❍	❍	❍	❍
I am locked into work procedures that are too inflexible.	❍	❍	❍	❍	❍	❍	❍
A major satisfaction in my life comes from my work.	❍	❍	❍	❍	❍	❍	❍
I've lost all hope of getting an satisfaction from my job.	❍	❍	❍	❍	❍	❍	❍

	Strongly Agree	Agree	Slightly Agree	Neither Agree nor Disagree	Slightly Disagree	Disagree	Strongly Disagree
I just want to put in my 15 or 20 years and keep my nose clean.	❍	❍	❍	❍	❍	❍	❍
No matter what happens on my job, I have to think of myself first.	❍	❍	❍	❍	❍	❍	❍
I really don't care for my job.	❍	❍	❍	❍	❍	❍	❍
Someone who works hard and is conscientious is foolish.	❍	❍	❍	❍	❍	❍	❍
Every chance I get, I goof off on the job.	❍	❍	❍	❍	❍	❍	❍
If I could, I would fool my workplace into believing I was doing a good job, even if I actually wasn't.	❍	❍	❍	❍	❍	❍	❍
Personal gain, not professionalism, is what influences me in my work.	❍	❍	❍	❍	❍	❍	❍

	Strongly Agree	Agree	Slightly Agree	Neither Agree nor Disagree	Slightly Disagree	Disagree	Strongly Disagree
The organization I work for is well managed.	❍	❍	❍	❍	❍	❍	❍
I get satisfactory information from management.	❍	❍	❍	❍	❍	❍	❍
Management makes an effort to get the opinions of workers.	❍	❍	❍	❍	❍	❍	❍
People at the top are aware of problems at my level.	❍	❍	❍	❍	❍	❍	❍
My immediate boss is doing a good job.	❍	❍	❍	❍	❍	❍	❍
I receive recognition for doing my job well.	❍	❍	❍	❍	❍	❍	❍
I often doubt the truth of the things management says.	❍	❍	❍	❍	❍	❍	❍
Management will take advantage of you if given the chance.	❍	❍	❍	❍	❍	❍	❍

	Strongly Agree	Agree	Slightly Agree	Neither Agree nor Disagree	Slightly Disagree	Disagree	Strongly Disagree
My concerns about pay are dealt with fairly.	❍	❍	❍	❍	❍	❍	❍
My company has a fair chance for advancement.	❍	❍	❍	❍	❍	❍	❍
I like the kind of work I do.	❍	❍	❍	❍	❍	❍	❍
My employer considers my job important.	❍	❍	❍	❍	❍	❍	❍
I am satisfied overall with my organization.	❍	❍	❍	❍	❍	❍	❍

Time Urgency

On the questions that follow, you will find a series of rating scales that you can use to describe how you use and perceive TIME. Refer to the first question below, Time Awareness, as you read the instructions below. At the top, there is a label, which describes the aspect of time that the rating scale covers. In the first question below, this aspect is AWARENESS OF TIME. Below the label, there is a definition, which describes what is meant by the label in some detail. Below this definition is the actual rating scale. Your task is to use that rating scale to describe how aware you are of time. You will do this by choosing 1 of the 7 numbers that appears on the vertical scale. The higher the number, the more aware of time you are; the lower the number, the less aware of time you are.The statements on the right side of the scale are to help you define what is HIGH, AVERAGE, or LOW Awareness of Time. There is not a statement for every point on the scale. A person who is very aware of time would be one who glances at his or her watch frequently during the day. If this is the level of awareness of time that describes yourself, you would rate yourself as a "7" or "6" on the scale. In contrast, people who are not very aware of time would not look at a watch, clock, or calendar very much -- in this case, you would rate yourself as a "1" or "2". Please select the number that best describes your perceptions of time.Please note that each of the main questions (e.g. "awareness of time") are repeated. In some cases, some or all of the items are repeated. Despite this, please do answer all the questions.

Awareness of Time
The extent to which an individual is aware of the exact time of day, regardless of the environment or circumstances. The extent to which a person is aware of important dates such as birthdays, tests, etc.
- 7 (high) I glance at my watch frequently during the day
- 6 Even when I can't look at a watch or clock, I know approximately what time it is
- 5 I often lose track of time when I am engaged in an activity
- 4 (average) Sometimes I remember the birthday of a close friend or relative a day or two after it has passed
- 3 I must often be reminded of important dates
- 2 I seldom look at my watch or clock
- 1 (low) Occasionally, I forget what day of the week it is

Awareness of Time
The extent to which an individual is aware of the exact time of day, regardless of the environment or circumstances. The extent to which a person is aware of important dates such as birthdays, tests, etc.
- 7 (high) When I awake at night, I like to see what time it is
- 6 I prefer a digital watch because it gives more accurate time
- 5 I am sometimes unsure of the date
- 4 (average) I often lose track of time
- 3 I do not pay much attention to daily calendars
- 2
- 1 (low) I often forget birthdays and assignment dates until someone reminds me of them

Deadline Control

The extent to which an individual creates or appears to be controlled by external deadlines.

❍ 7 (high) I pay bills as soon as I get them
❍ 6 If I am not given a deadline for a particular activity, I set my own
❍ 5 I am always preparing for some event
❍ 4 (average) I set deadlines for myself only when they are necessary
❍ 3 I prefer to concentrate on the quality of my accomplishments rather than if they are done on time or by a deadline
❍ 2 I seldom set deadlines for myself
❍ 1 (low) I often request extensions on deadlines and assignments

Deadline Control

The extent to which an individual creates or appears to be controlled by external deadlines.

❍ 7 (high) I pay bills as soon as I get them
❍ 6 If I am not given a deadline for a particular activity, I set my own
❍ 5 I am always preparing for some event
❍ 4 (average) I set deadlines for myself only when they are necessary
❍ 3 I prefer to concentrate on the quality of my accomplishments rather than if they are done on time or by a deadline
❍ 2 I seldom set deadlines for myself
❍ 1 (low) I often request extensions on deadlines and assignments

Eating Behavior

The extent to which time plays a role in the manner by which individuals plan or eat various meals.

- ❍ 7 (high)
- ❍ 6 I am eating second helpings while others are still finishing their first helpings
- ❍ 5I eat about as much as everyone else at the table
- ❍ 4 (average) I always give myself enough time for a meal
- ❍ 3 I have never been told that I eat either too fast or too slow
- ❍ 2 I prepare elaborate meals when I cook
- ❍ 1 (low) Companions often have several cups of coffee while waiting for me to finish my meal

Eating Behavior

The extent to which time plays a role in the manner by which individuals plan or eat various meals.

- ❍ 7 (high) I am often the first person finished eating at the table
- ❍ 6
- ❍ 5
- ❍ 4 (average) I converse with others while eating
- ❍ 3 I always feel satisfied after a meal
- ❍ 2 I tend to cut my food into small pieces
- ❍ 1 (low) I eat in a slow and relaxed manner

List Making

The extent to which a person engages in actions directed toward saving time through more efficient planning or action.

- ⭕ 7 (high) As I complete tasks, I enjoy crossing them off a list
- ⭕ 6 I often update lists as I accomplish various goals
- ⭕ 5
- ⭕ 4 (average) My lists of things to do are usually broad and lacking in detail
- ⭕ 3 I have made lists of things to do but often lose them
- ⭕ 2
- ⭕ 1 (low) I seldom make a "things to do" list

List Making

The extent to which a person engages in actions directed toward saving time through more efficient planning or action.

- ⭕ 7 (high) When I am preparing for a trip, I make a list of things to do or things to bring
- ⭕ 6 If I get bogged down, I make a "things to do " list
- ⭕ 5
- ⭕ 4 (average) Most of my lists are mental rather than written down
- ⭕ 3 I find lists of "things to do" limiting on my behavior
- ⭕ 2
- ⭕ 1 (low) I avoid making lists to the extent possible

Nervous Energy
The extent to which a person can be characterized as being in constant motion, even when "resting".
- ❍ 7 (high)There is rarely a time when some part of me is not moving
- ❍ 6 I often drum my pencil on a desk or some other surface when I am bored
- ❍ 5 I tap my feet or fingers when I am sitting down
- ❍ 4 (average)
- ❍ 3
- ❍ 2
- ❍ 1 (low) I can sit comfortably for several hours at a time

Nervous Energy
The extent to which a person can be characterized as being in constant motion, even when "resting".
- ❍ 7 (high) I become irritable when I sit for several hours without doing something
- ❍ 6 I tend to pace when I talk or think
- ❍ 5 I chew gum frequently and quickly
- ❍ 4 (average) I often look around at others when I am bored
- ❍ 3
- ❍ 2
- ❍ 1 (low) I can sit comfortably for several hours at a time

Scheduling
The extent to which an individual schedules activities and keeps to that schedule. The schedule might include leisure, personal, and/or work activities. This also includes the extent to which an individual apportions time for particular activities.
- 7 (high) I allow a specific amount of time for each activity that I engage in
- 6 I like to schedule activities and appointments but am not overly upset if the schedules must change
- 5
- 4 (average) Although I often have a rough plan for each day, I do not mind abandoning the plan if necessary
- 3 My schedule is flexible enough so that it allows for unforeseen events.
- 2 I often make plans on the spur of the moment rather than in advance.
- 1 (low) I do not have a daily schedule

Scheduling
The extent to which an individual schedules activities and keeps to that schedule. The schedule might include leisure, personal, and/or work activities. This also includes the extent to which an individual apportions time for particular activities.
- 7 (high) I prefer to make a telephone call rather than write a letter
- 6 I like my friends to be aware of and respect my schedule
- 5
- 4 (average) I will juggle entries in my schedule when necessary
- 3
- 2 I forget about schedules after I have made them
- 1 (low) I live from day to day without any particular schedule for my activities

Speech Patterns
The extent to which an individual exhibits rushed speech patterns. Such patterns include talking fast, interrupting others, and finishing the sentences of others.
- ○ 7 (high)
- ○ 6 I will finish the sentence or supply a word to a person if I feel that they can't seem to find the right words
- ○ 5 I find that I adjust the speed of my speech to match the speed of those with whom I am talking
- ○ 4 (average) I listen patiently to others until they are finished talking
- ○ 3 I never interrupt someone who is speaking
- ○ 2 I never interrupt or rush others when they are speaking
- ○ 1 (low) I welcome interruptions

Speech Patterns
The extent to which an individual exhibits rushed speech patterns. Such patterns include talking fast, interrupting others, and finishing the sentences of others.
- ○ 7 (high) If I don't get specific information from a person, I interrupt them with a direct question
- ○ 6 I interrupt people if I think that what I have to say will help them
- ○ 5 I have never been told that I speak too slowly or too quickly
- ○ 4 (average) I am just as happy listening as talking
- ○ 3 I often feel pushed by others to speak more quickly
- ○ 2 I speak slowly and deliberately
- ○ 1 (low) I prefer to listen than to speak

Please think about the team that you have been working with recently. Please be assured that your team members will never see your responses to these questions. Thinking about your team, rate each of the statements below from "strongly agree" to "strongly disagree"

	Strongly Agree	Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Disagree	Strongly Disagree
There is a great deal of trust among members of my work group.	❍	❍	❍	❍	❍	❍	❍
Members of my group work together as a team.	❍	❍	❍	❍	❍	❍	❍
The members of my work group are cooperative with each other.	❍	❍	❍	❍	❍	❍	❍
My work group members know that they can depend on each other.	❍	❍	❍	❍	❍	❍	❍

	Strongly Agree	Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Disagree	Strongly Disagree
The members of my work group stand up for each other.	○	○	○	○	○	○	○
The members of my work group regard each other as friends.	○	○	○	○	○	○	○
The team is cohesive.	○	○	○	○	○	○	○
The team has group spirit.	○	○	○	○	○	○	○
I would describe this team to my friends as a great team to work in.	○	○	○	○	○	○	○
I am willing to exert considerable effort to meet team deadlines	○	○	○	○	○	○	○

	Strongly Agree	Agree	Somewh at Agree	Neither Agree nor Disagree	Somewh at Disagree	Disagree	Strongly Disagree
I will do extra work to meet team deadlines	○	○	○	○	○	○	○
I will work hard to meet team deadlines	○	○	○	○	○	○	○
I will do everything necessary to help my team meet its deadlines	○	○	○	○	○	○	○

Have you ever worked as an Information Systems professional? This would include programmers, system analysts, software architects, system administrators, network administrators, or any other type of job where you helped provide a computer platform to other people. This would NOT include simply using a computer as an end user.
○ Yes, I have worked as an IS professional
○ No, I have not worked as an IS professional

Have you ever worked as an Information Systems manager? This would include being the manager of a group of programmers, system analysts, software architects, system administrators, network administrators, or any other type of job where your group helped provide a computer platform to other people. This would NOT include simply using a computer as an end user, or providing computer artifacts (like spreadsheets) to other people. It would also NOT include being purely a technical lead (i.e., you were not responsible for scheduling, hiring, firing, performance reviews, or other managerial duties).
○ Yes, I have managed a group of IS professionals
○ No, I have not managed a group of IS professionals

Have you ever managed any group of workers, whether they were IS professionals or not?
○ Yes, I have been a manager
○ No, I have not been a manager

Regardless of whether you are currently employed or not, how many years total have you been employed in all jobs you have held?

❍ I have never been employed
❍ 0-2 years
❍ 2-5 years
❍ 5-10 years
❍ 10-20 years
❍ 20 or more years

Regardless of whether you are currently employed or not, how many years total have you been employed as an Information Systems Professional in all such jobs you have held?

❍ I have never been employed as an IS professional
❍ 0-2 years
❍ 2-5 years
❍ 5-10 years
❍ 10-20 years
❍ 20 or more years

Appendix 2: Semi-Structured Interview

General Questions

We are currently studying how people interact in the workplace. All information we are gathering will be kept strictly confidential. We will only release information gathered in aggregate form, so that no person's responses can be identified.

Please describe what kind of conflicts you commonly encounter in your work, either with your supervisor, peers, or people who report to you. (response)

How does that conflict make you feel? (response)

Do you think IT workers are different from other kinds of workers? How? (response)

What would you say are the most unreasonable demands upon you {in your workplace / from your team members}? (response)

Are differences among people in the workplace important? Are the differences inherently important, or are they arbitrarily made important by {management / team members}? (response)

What do you see as the largest challenges of with {distributed teams / your supervisor / IT workers / your team}? (response)

If you were to leave your job, what would be the primary reasons? (response)

More Specific Questions

Do you feel like you are different from {your supervisor / your teammates / IT workers}? How? (response)

Does conflict with {your team / your peers / your supervisor} cause you to become stressed and/or cynical? (response)

We have all heard about time management tools. Does {your team / your supervisor / you} use any of these tools, and, if so, which ones? (response)

Did any of those tools make it harder for you to work productively, and if so, how? (response)

Entrainment is a way of ensuring that everyone works with time the same way. For instance, a weekly status meeting entrains you to both have an accomplishment every week, and to observe a deadline for when that accomplishment has to happen. Can you give me an example of how this works in your team? (repsonse)

If your team had good entrainment, how did that work out for you personally? (response)

Did you feel like you were more or less in sync with the team? (response)

What changes at work would improve your work environment? (response)

Focused / Leading Questions

There are three types of conflict that we think happen in teams. Task conflict is a conflict between ideas about how the task should be completed; for instance, should we use a database to store images, or should they be stored in a file system? Can you think of any incidents involving task conflict in your team? (response)

Is task conflict common in your team? (response)

Process conflict is conflict about how the group works or allocates its resources; for

instance, should we talk whenever we think it's appropriate, or do we need a formal control for who gets to talk when? Can you think of any incidents involving process conflict on your team? (response)

Relational conflict is conflict between personalities; for instance, ignoring a team member's input because you don't think that they like you. Can you think of any incidents involving process conflict on your team? (response)

Do you feel that there are differences in the way that you and {your team members / your supervisor / your peers} use time? What are those differences? (response)

Would a change in the way that {your team / your supervisor / your peers} uses time reduce your stress? (response)

Would a change in the way that {your team / your supervisor / your peers} uses time make you more productive? (response)

Would a change in the way that {your team / your supervisor / your peers} uses time reduce your cynicism? (response)

Chronicity or multitasking is a temporal characteristic. Some people naturally prefer to perform multiple tasks simultaneously or in quick succession, shifting attention to whatever needs it at the moment. Other people find this exhausting, and would prefer to work on one task until it is complete, without interruption, before moving on to the next task. Are you polychronic or monochronic? (response)

{Is your supervisor / are your peers / are your team members}' chronicity different from yours? Does this cause difficulties at work? (response)

Chronotype is a temporal characteristic that describes when in the day people prefer to work. Some people are morning people, and other people are evening people. Are you a morning or an evening person? (response)

{Is your supervisor / are your peers / are your team members}' chronotype different from yours? Does this cause difficulties at work? (response)

Time urgency is a temporal characteristic which measures how concerned you are with deadlines. Are you highly aware of deadlines? Are they important to you? (response)

{Is your supervisor / are your peers / are your team members}' time urgency different from yours? Does this cause difficulties at work? (response)

Temporal focus is a temporal characteristic that examines whether you focus on the past, present, or future. Where is your temporal focus? (response)

{Is your supervisor / are your peers / are your team members}' temporal focus different from yours? Does this cause difficulties at work? (response)

Temporal dissonance is a feeling of discomfort when you have temporal characteristics that differ from those in the workplace. Do you ever feel temporal dissonance? (response)

Could you describe how it felt? (response)

Did you do anything to try to reduce those feelings, and, if so, what? (response)

Appendix 3: IRB Approvals

UNIVERSITY OF
ARKANSAS
— THE YOU OF A —

120 Ozark Hall • Fayetteville, Arkansas 72701 • (479) 575-2208 • (479) 575-3846 (FAX)
Email: irb@uark.edu

Research Support and Sponsored Programs
Institutional Review Board

December 2, 2010

MEMORANDUM

TO: Christopher Conway
                           Moez Limayem

FROM: Ro Windwalker
                           IRB Coordinator

RE: New Protocol Approval

IRB Protocol #:   10-11-317
Protocol Title: *Individuals and Time*
Review Type: ☒ EXEMPT ☐ EXPEDITED ☐ FULL IRB
Approved Project Period: Start Date: 12/02/2010 Expiration Date: 12/01/2011

Your protocol has been approved by the IRB. Protocols are approved for a maximum period of one year. If you wish to continue the project past the approved project period (see above), you must submit a request, using the form *Continuing Review for IRB Approved Projects*, prior to the expiration date. This form is available from the IRB Coordinator or on the Compliance website (http://www.uark.edu/admin/rsspinfo/compliance/index.html). As a courtesy, you will be sent a reminder two months in advance of that date. However, failure to receive a reminder does not negate your obligation to make the request in sufficient time for review and approval. Federal regulations prohibit retroactive approval of continuation. Failure to receive approval to continue the project prior to the expiration date will result in Termination of the protocol approval. The IRB Coordinator can give you guidance on submission times.

If you wish to make *any* modifications in the approved protocol, you must seek approval *prior to* implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

If you have questions or need any assistance from the IRB, please contact me at 120 Ozark Hall, 5-2208, or irb@uark.edu.

UNIVERSITY OF
ARKANSAS
— THE YOU OF A —

120 Ozark Hall • Fayetteville, Arkansas 72701 • (479) 575-2208 • (479) 575-3846 (FAX)
Email: irb@uark.edu

Research Compliance
Institutional Review Board

April 26, 2011

MEMORANDUM

TO:	Christopher Conway
	Moez Limayem
FROM:	Ro Windwalker
	IRB Coordinator
RE:	PROJECT MODIFICATION

IRB Protocol #:	10-11-317
Protocol Title:	*Individuals and Time*
Review Type:	☒ EXEMPT ☐ EXPEDITED ☐ FULL IRB
Approved Project Period:	Start Date: 04/26/2011 Expiration Date: 12/01/2011

Your request to modify the referenced protocol has been approved by the IRB. **This protocol is currently approved for 1800 total participants.** If you wish to make any further modifications in the approved protocol, including enrolling more than this number, you must seek approval *prior to* implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

Please note that this approval does not extend the Approved Project Period. Should you wish to extend your project beyond the current expiration date, you must submit a request for continuation using the UAF IRB form "Request for Continuation." The request should be sent to the IRB Coordinator, 120 Ozark Hall.

For protocols requiring FULL IRB review, please submit your request at least one month prior to the current expiration date. (High-risk protocols may require even more time for approval.) For protocols requiring an EXPEDITED or EXEMPT review, submit your request at least two weeks prior to the current expiration date. Failure to obtain approval for a continuation *on or prior to* the currently approved expiration date will result in termination of the protocol and you will be required to submit a new protocol to the IRB before continuing the project. Data collected past the protocol expiration date may need to be eliminated from the dataset should you wish to publish. Only data collected under a currently approved protocol can be certified by the IRB for any purpose.

If you have questions or need any assistance from the IRB, please contact me at 120 Ozark Hall, 5-2208, or irb@uark.edu.

UNIVERSITY OF ARKANSAS

November 28, 2011

MEMORANDUM

TO:	Christopher Conway Moez Limayem
FROM:	Ro Windwalker IRB Coordinator
RE:	PROJECT CONTINUATION
IRB Protocol #:	10-11-317
Protocol Title:	*Individuals and Time*
Review Type:	☒ EXEMPT ☐ EXPEDITED ☐ FULL IRB
Previous Approval Period:	Start Date: 12/02/2010 Expiration Date: 12/01/2011
New Expiration Date:	12/01/2012

Your request to extend the referenced protocol has been approved by the IRB. If at the end of this period you wish to continue the project, you must submit a request using the form *Continuing Review for IRB Approved Projects*, prior to the expiration date. Failure to obtain approval for a continuation on or prior to this new expiration date will result in termination of the protocol and you will be required to submit a new protocol to the IRB before continuing the project. Data collected past the protocol expiration date may need to be eliminated from the dataset should you wish to publish. Only data collected under a currently approved protocol can be certified by the IRB for any purpose.

This protocol has been approved for 2,600 participants. If you wish to make *any* modifications in the approved protocol, including enrolling more than this number, you must seek approval *prior to* implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

If you have questions or need any assistance from the IRB, please contact me at 210 Administration Building, 5-2208, or irb@uark.edu.

210 Administration Building • 1 University of Arkansas • Fayetteville, AR 72701
Voice (479) 575-2208 • Fax (479) 575-3846 • Email irb@uark.edu

The University of Arkansas is an equal opportunity/affirmative action institution.

UNIVERSITY OF ARKANSAS

April 6, 2012

MEMORANDUM

TO: Christopher Conway
                Moez Limayem

FROM: Ro Windwalker
                IRB Coordinator

RE: PROJECT MODIFICATION

IRB Protocol #:   10-11-317

Protocol Title: *Individuals and Time*

Review Type: ☒ EXEMPT   ☐ EXPEDITED   ☐ FULL IRB

Approved Project Period: Start Date: 04/06/2012 Expiration Date: 12/01/2012

Your request to modify the referenced protocol has been approved by the IRB. **This protocol is currently approved for 2,600 total participants.** If you wish to make any further modifications in the approved protocol, including enrolling more than this number, you must seek approval *prior to* implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

Please note that this approval does not extend the Approved Project Period. Should you wish to extend your project beyond the current expiration date, you must submit a request for continuation using the UAF IRB form "Continuing Review for IRB Approved Projects." The request should be sent to the IRB Coordinator, 210 Administration.

For protocols requiring FULL IRB review, please submit your request at least one month prior to the current expiration date. (High-risk protocols may require even more time for approval.) For protocols requiring an EXPEDITED or EXEMPT review, submit your request at least two weeks prior to the current expiration date. Failure to obtain approval for a continuation *on or prior to* the currently approved expiration date will result in termination of the protocol and you will be required to submit a new protocol to the IRB before continuing the project. Data collected past the protocol expiration date may need to be eliminated from the dataset should you wish to publish. Only data collected under a currently approved protocol can be certified by the IRB for any purpose.

If you have questions or need any assistance from the IRB, please contact me at 210 Administration Building, 5-2208, or irb@uark.edu.

210 Administration Building • 1 University of Arkansas • Fayetteville, AR 72701
Voice (479) 575-2208 • Fax (479) 575-3846 • Email irb@uark.edu

The University of Arkansas is an equal opportunity/affirmative action institution.

UNIVERSITY OF ARKANSAS

November 14, 2011

MEMORANDUM

TO:	Christopher Conway
	Moez Limayem
FROM:	Ro Windwalker
	IRB Coordinator
RE:	New Protocol Approval

IRB Protocol #:   11-09-097

Protocol Title: *Time and Conflict in Teams*

Review Type: ☐ EXEMPT   ☒ EXPEDITED   ☐ FULL IRB

Approved Project Period: Start Date: 11/14/2011 Expiration Date: 11/13/2012

Your protocol has been approved by the IRB. Protocols are approved for a maximum period of one year. If you wish to continue the project past the approved project period (see above), you must submit a request, using the form *Continuing Review for IRB Approved Projects*, prior to the expiration date. This form is available from the IRB Coordinator or on the Research Compliance website (http://vpred.uark.edu/210.php). As a courtesy, you will be sent a reminder two months in advance of that date. However, failure to receive a reminder does not negate your obligation to make the request in sufficient time for review and approval.   Federal regulations prohibit retroactive approval of continuation. Failure to receive approval to continue the project prior to the expiration date will result in Termination of the protocol approval. The IRB Coordinator can give you guidance on submission times.

This protocol has been approved for 100 participants. If you wish to make *any* modifications in the approved protocol, including enrolling more than this number, you must seek approval *prior to* implementing those changes.   All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

If you have questions or need any assistance from the IRB, please contact me at 210 Administration Building, 5-2208, or irb@uark.edu.

210 Administration Building • 1 University of Arkansas • Fayetteville, AR 72701
Voice (479) 575-2208 • Fax (479) 575-3846 • Email irb@uark.edu

The University of Arkansas is an equal opportunity/affirmative action institution.