"You Want It When?" How Temporal Dissonance in IT Workers Contributes to Project Failures

Completed Research Paper

Christopher M. Conway
University of Arkansas
204 Business Building
Fayetteville, AR 72701
cconway@walton.uark.edu

Moez Limayem
University of Arkansas
328K Business Building
Fayetteville, AR 72701
mlimayem@walton.uark.edu

Abstract

IT projects continue to fail too frequently. One reason for these failures is interpersonal and motivational issues in IT workers. One possible cause for these issues is increased temporal dissonance in IT workers, which causes stress and cynicism. In study 1, we develop a measure of temporal dissonance and show its effect on stress. Study 2 extends and confirms study 1, showing that increased temporal dissonance results in increased stress and increased workplace cynicism. Study 2 also partially confirms that there are differing temporal characteristics between IT workers and managers which may cause temporal dissonance.

Keywords: temporal dissonance, temporal congruity, stress, IT 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 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.

One possible source of IT worker stress may be found in their temporal characteristics, which may not match more traditional white collar worker profiles. For instance, people whose cortisol levels rise later in the day ("owls") seem to be somewhat more creative than their morning ("lark") counterparts (Giampietro and Cavallera 2007). This increase in creativity would be an advantage in creative work such as IT project implementation, but is less present in the stereotypical manager, who is a lark. Some attention has been paid to temporal characteristics at the organizational level, detailing the potentially devastating effects of a lack of temporal congruity (Bluedorn and Denhardt 1988; Ryan 2008; Standifer and Bluedorn 2006). Suggestions for improving congruence include entrainment and time management techniques, with the expectation that these would also improve individual performance. 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 A. C. Bluedorn 1999) These problems are even more likely to be found in distributed teams, as individuals from different areas with different ways of using time and differing physical time are brought together (M. P. E. Cunha and R. C. E. Cunha 2004; O'Leary and Cummings 2007). 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). One area that this prior work neglects is an understanding of the underlying psychological or social mechanisms by which this congruence affects performance. Existing models of time management have also thus fair failed to solve congruence issues (Claessens, Eerde, Rutte, and Roe 2007; Macan 1994).

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 questions, then, are: Do IT workers experience time differently from their managers? Do IT workers experience more temporal dissonance than their managers? And, Does temporal dissonance have negative consequences? We answer this by developing a measure for temporal dissonance. We create an instrument and document its psychometric properties. We show that temporal dissonance is created from the interaction of temporal congruity and salience, and that increased temporal dissonance increases stress and cynicism. Finally, we show that some temporal characteristics differ between IT workers and managers, and that IT workers do experience more temporal dissonance than managers.

Our paper follows a standard model. We first examine the prior work in more depth in the "background" section. We then develop the theory of temporal dissonance in the individual in the "model" section. For each study, we describe the instruments we designed and used, and the method for their testing in the "method" section. The results of each study are presented in the "results" section. Finally, we note implications for theory and for practice, and point toward avenues for future research in the "conclusion" section.

Background

Most research views time as an immutable and objective measure of 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, researchers 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.

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 (A. C. 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). Seasonal variation is not limited to deciduous trees; illnesses such as Seasonal Affective Disorder are caused by differences in the seasons (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). While these psychological constructs are created through the interaction of social time structures and biological time structures, eventually they take on a life of their own in the individual.

Biological and psychological times are individual traits. 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 (A. C. 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 A. C. 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 caesium atom (NIST 2009) is an example of this kind of time. 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).

This underscores 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 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. 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 (A. C. Bluedorn and Denhardt 1988; Slocombe and A. C. Bluedorn 1999). 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.

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 A. Bluedorn 2006) and the negative impact of lack of congruity (M. P. E. Cunha and R. C. E. Cunha 2004). 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 difference on only one dimension? Several of these studies give a couple of useful clues as the 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 (Ryan 2008) (M. P. E. Cunha and R. C. E. Cunha 2004) (Labianca, Moon, and Watt 2005) (Gersick 1988).

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 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 concept of incongruent temporal structures itself is similar to the causes of 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 begin to construct our model of what temporal dissonance is and how it works.

Theoretical Model

Figure 1 summarizes the causal model. Hypotheses 1, 2, 3, 4, and 6 concern differences between means of two groups (IT workers and managers), so are not shown on the figure. The links between the temporal characteristics and temporal structures, and temporal structures and temporal congruity, are constructed rather than causal, so have no hypotheses associated with them. The group differences and causal model elements are discussed below. The following sections detail and explain these relationships.

Figure 1: Causal Model Summary
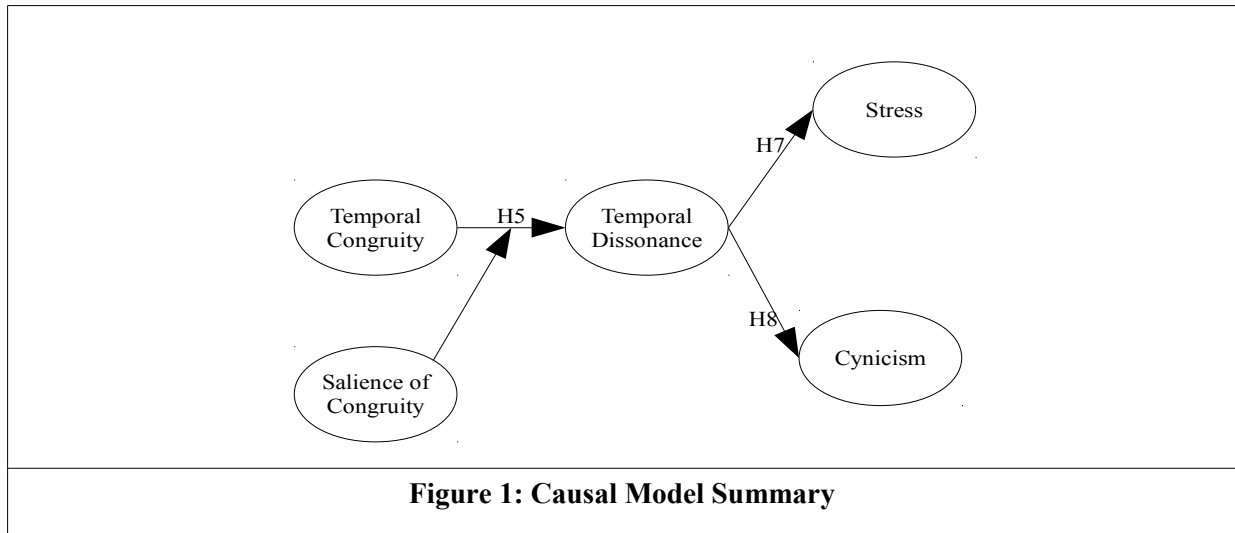
The Effect of Worker Type on Chronotype

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 programmers[1] 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 tapering off as the day wears on. This suggests that their body releases 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 the their cortisol levels, and fairly rapidly decline (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.

---

[1]   In this paper, we use "IT developers", "IT workers", and "programmers" interchangeably to mean the same thing: people who design and code computer programs.

2007). This suggests that rather than one rapid pulse, owl's bodies release cortisol at a steadier level during the day, resulting in less dramatic changes in arousal level.

It is interesting to note this difference in the patterns of cortisol level between the lark and the owl. It is not merely that the peak happens at different times, 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 2 below.
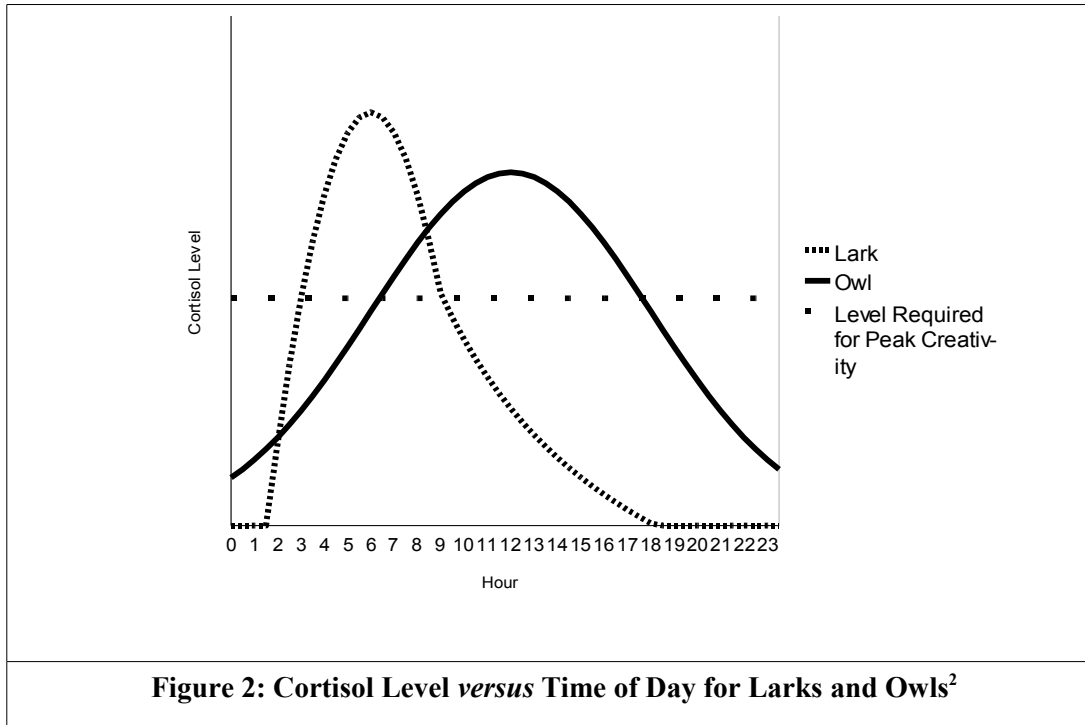
Figure 2: Cortisol Level *versus* Time of Day for Larks and Owls[2]

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 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 programmer keep many details in mind at the same time. Programming is a creative and holistic task, in which the programmer 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 programmer to maintain this load effectively, her arousal needs to be fairly high. Since this is the main work task for a programmer, 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 programmers need to have a broad cortisol peak. As can be seen from the Figure 2, this is more likely true for owls than it is for larks. From this, we can expect that there will be a tendency for programmers 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

---

[2]   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, & Hellhammer, 2007), (Kudielka, Federenko, Hellhammer, & Wüst, 2006), and (Horne and Ostberg 1976) for more exact information on the curve shapes

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 doe, and thus can be accomplished with lower cognitive load, and, hence, lower arousal levels. This would, in fact, be generally true of most other general 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, general managers will benefit less from being owls than programmers would. This tendency will lead to programmers being more likely to be owls than their manager.

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

H1: Programmers will have a chronotype closer to the evening end of the spectrum than general managers; *i.e.,* the mean chronotype score for programmers will be lower than the mean chronotype score for managers.

The Effect of Worker Type on Polychronicity

There is a stereotype of the programmer that holds them to be antisocial and solitary in their work. Ondine, a typical programmer, 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.

When deep within a coding task, programmers 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 programmer is less aware of the passage of time and of outside stimuli. Because the programmer 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 programmer 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 programmer. Thus, the ability of a programmer to shut out external stimuli will improve their performance. Achieving this state requires that the programmer 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 programmers 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, Goldstein, and Smith 1995) will support this characteristic in programmers that stay in the field.

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 programmers are.

H2: General managers will have a higher polychronicity than programmers; *i.e.,* the mean chronicity score for managers will be higher than the mean chronicity score for programmers.

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, programmers 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 programmers are likely to be considerably lower in time urgency than managers are.

H3: General managers will have higher time urgency than programmers; *i.e.,* the mean urgency score for managers will be higher than the mean urgency score for programmers.

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., (Slocombe and A. C. Bluedorn 1999) (A. C. Bluedorn and Denhardt 1988)). 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 congruity.

This can most readily be seen by visualizing polychronicity and chronotype as axes for a scatterplot; see Figure 3 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.
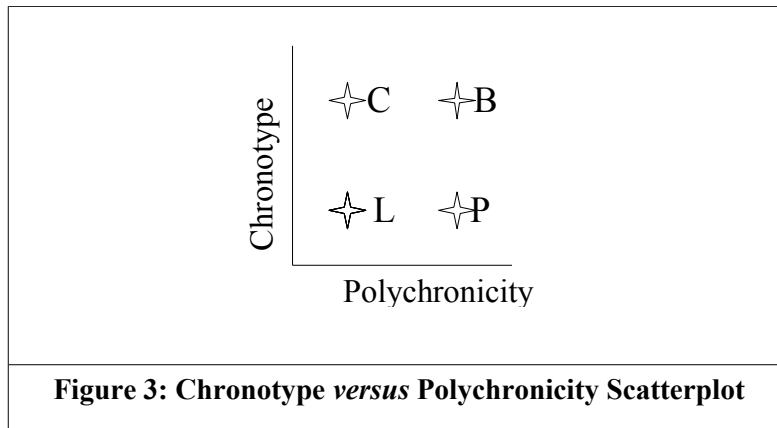
Figure 3: Chronotype *versus* Polychronicity Scatterplot

Since the creation of temporal structures from temporal characteristics is a construction rather than a causal relationship, there are no hypotheses associated with the link between the temporal characteristics and temporal structures. However, because the characteristics we are using are orthogonal, differences present in the characteristics used to create the temporal structure will be preserved in the temporal structure, 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 programmers, general managers, and general workers have a specific pattern of differences in their individual temporal characteristics, these differences should carry through in the comparison between the temporal structures we have created. The previous discussion indicated that programmers should differ from both general managers in chronicity, time urgency, and chronotype. We would, therefore, expect that the manager will experience greater temporal congruity than the programmer.

H4: Managers will experience higher temporal congruity than programmers; *i.e.,* the mean congruity score for managers will be higher than the mean congruity score for programmers.

The Effect of Temporal Congruity and Internalization Requirements 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 the 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 normal desires, 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 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 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.

While this example has been purely about chronotype, there is no particular reason that it should be different from other temporal characteristics. In fact, it may be that slight differences on any particular characteristic may not cause difficulty, but when combined with slight differences on other temporal characteristics can rise to the level where difficulties occur. Because of this, it makes sense to consider congruity in the totality of a person's temporal structure with the temporal structures that the individual may encounter, and 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 the interaction hypotheses somewhat, they are also summarized in Table 1.

Table 1: Hypothesis 5 Summary		
Internalization Requirement	Temporal Congruity	Temporal Dissonance
Low	Low	Low (H5C)
High	Low	High (H5A)
Low	High	Low (H5B and H5C)
High	High	Low (H5B)

H5A: When the temporal congruity between an individual's temporal structure and one or more external temporal structures with high internalization requirements (salience), the lack of congruity will cause high temporal dissonance in the individual.

H5B: When the temporal congruity is high between an individual's temporal structure and an external temporal structure, that external temporal structure will not cause temporal dissonance in the individual, regardless of the internalization requirement for the the external temporal structure.

H5C: When the internalization requirement for an external temporal structure is low, the individual's temporal dissonance will be low, regardless of the congruity of the temporal structures.

The Effect of Worker Type on Temporal Dissonance

We have seen previously that there is a difference in the temporal congruity between programmers and general managers. As noted with hypothesis 4, there is a tendency for the temporal congruity to be higher in general managers than for programmers. From hypothesis 5, we expect that this will lead to a difference in the temporal dissonance that programmers and general workers will feel, all else being equal.

H6: Programmers' levels of temporal dissonance will be higher than manager's level of temporal dissonance; *i.e.,* the mean temporal dissonance score for programmers will be higher than the mean temporal dissonance score for managers.

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 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 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 to have a negative impact on the individual's health.

H7: 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 rather than analytical reasons. 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.

H8: In increase in temporal dissonance in an individual will increase the cynicism felt by the individual.

Exploratory and Confirmatory Studies

We performed two studies to test our model. Since we are developing three new measures, an exploratory study which assesses primarily the measurement model is required. This first study will allow for removal of weak items and provide preliminary assessment of the validity of the core model. The second study is confirmatory. It uses the measure as defined by study 1 without further modification, which eliminates the possibility of capitalization on chance which exists when items are pruned from a measure. Study 2 then tests the full causal model. Additionally, we use the confirmatory study to test the expected differences in means between IT workers and managers on the temporal characteristics, temporal congruity, and temporal dissonance.

Study 1

Study one aims to produce a measure for temporal dissonance. For this purpose, it uses a reduced model, shown in Figure 4. For this study, the goal was primarily to assess the factor structure of the new measures, determine their reliability, and asses the convergent and discriminant validity of the measures.

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). 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 PhD 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 2. 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. The data were analyzed utilizing the R statistical package. 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.

Figure 4: Reduced Model for Study 1
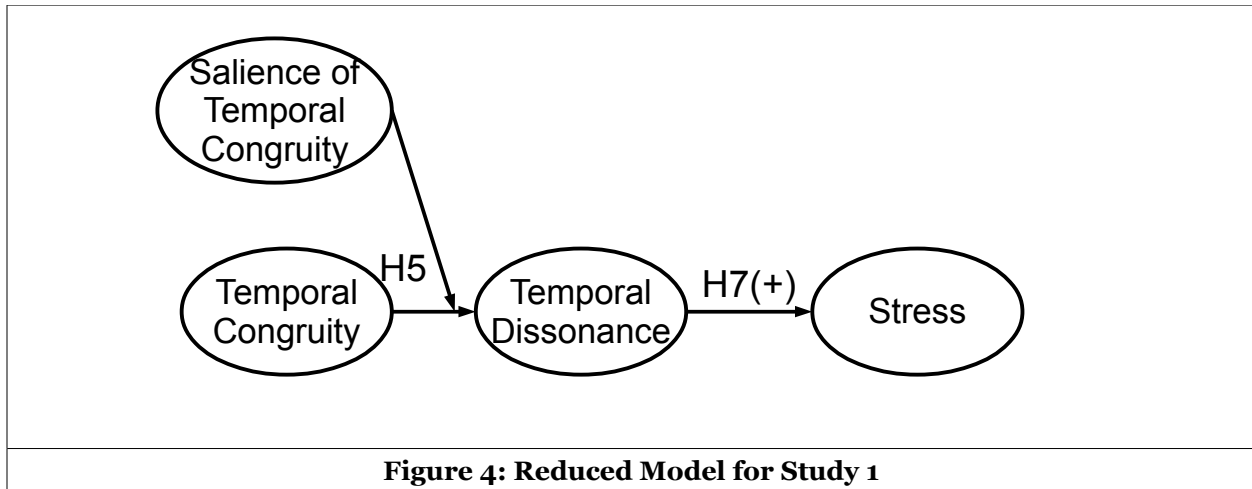
Results

We initially had 721 responses to the survey. After removing responses in which the new items and the stress items were not completed, we had 636 complete responses. Four of those responses was 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 differ on age or gender, so we pooled the data for the analysis.

For the next step, we removed data points which were outside the distribution of a χ2 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 χ2 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.

Construct	Tag	Item
Table 2: 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
IS Experience	isexp	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	exp	Regardless of whether you are currently employed or not, how many years total have you been employed in all jobs you have held?
Manager	mgr	Have you ever managed any group of workers, whether they were IS professionals or not?
Stress	(Study 2 only) Cohen et al. 1983 items (positive items only, no reverse-coded items)	
Chronicity	(Study 2 only) Lindquist and Kaufman-Scarborough 2007	
Chronotype	(Study 2 only) Horne and Ostberg 1976	
Cynicism	(Study 2 only) Kanter and Mirvis 1989	
Time Urgency	(Study 2 only) Conte et al. 1995	

We then constructed a measurement model for SEM analysis, using R version 2.12.2 and the lavaan package. 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, SRMR less than 0.08, and RMSEA less than 0.06 (Hu and Bentler 1999). For the unreduced model, we had an RMSEA of 0.0396, SRMR of 0.0316, and CFI of 0.967, 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 tables 3 (reliability) and 4 (correlations). This 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 3: 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

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 5.

Table 4: 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..364	0.562	0.684

Figure 5: Study 1 Causal Model Results (** p < 0.01)
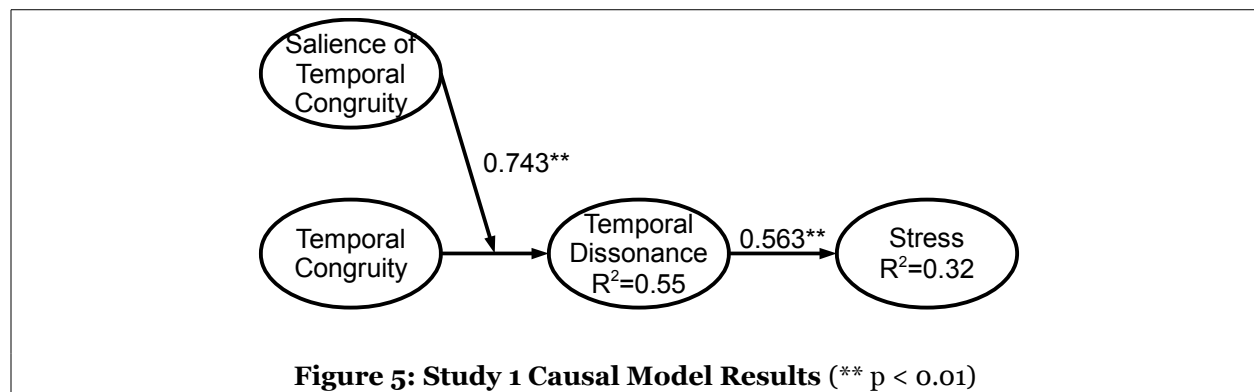
Study 2

For study 2, we returned to the full model shown in Figure 1. This study will provide a confirmatory factor analysis of the temporal dissonance measure, as well as test the full causal model and the hypothesized mean differences in characteristics between IT workers and managers.

Method

We extended the survey we used for study 1 with established measures of chronotype (Horne and Ostberg 1976), chronicity (Lindquist and Kaufman-Scarborough 2007), time urgency (Conte et al. 1995), and cynicism (Kanter and Mirvis 1989). We also added items to determine IS experience and managerial experience. 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. 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. To separate the two groups, we designated respondents who self-identified as an IT worker for most or all of their career, and did not report as ever having been a manager. We designated respondents who self-identified as having worked as a manager, and not to have spent much of their career as an IT worker. IT workers were *not* paired with their own manager; if they were, then the analysis could have been performed as the mean difference, and a larger effect might have been shown. The final sample for the comparison of means contained 156 IT workers and 138 managers. We compared the means using 1-tailed t-tests.

Results

Tables 5 and 6 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. We do not report reliability and correlations of the added established measures due to length restrictions. However, these results were also within acceptable values.
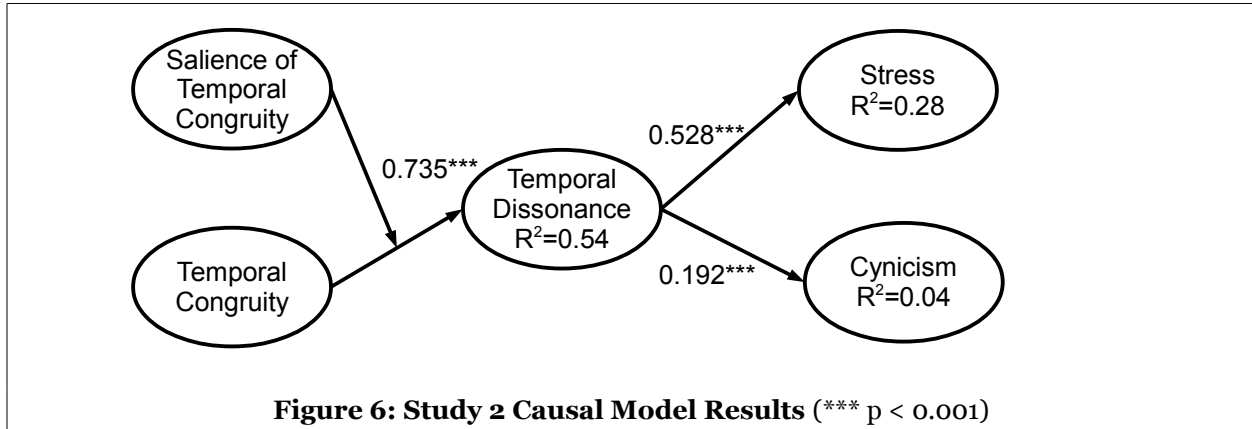
Table 5: Reliability and Convergent Validity			
Variable	Composite Reliability	Cronbach's α	AVE
Temporal Congruity	0.845	0.757	0.580
Salience of Temporal Congruity	0.767	0.421	0.626
Temporal Dissonance	0.925	0.908	0.578
Stress	0.877	0.834	0.525

Table 6: Correlations				
Diagonal is $\sqrt{AVE}$	Temporal Congruity	Salience of Temporal Congruity	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 5, 7, and 8. The results are summarized in Figure 6 H5, that the interaction of salience and temporal congruity causes temporal dissonance, was supported (p<0.001). H7, that temporal dissonance causes stress, was also supported (p<0.001). H8, that temporal dissonance causes cynicism, was supported (p<0.001), though the variance explained was very small (4%).

We then compared the means for each of the groups on chronotype, chronicity, time urgency, temporal congruity, and temporal dissonance. The results are summarized in Table 7.

Figure 6: Study 2 Causal Model Results (*** p < 0.001)

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
H6 (temporal dissonance)	2.86	2.67	2.04 (0.021)	Yes	IT workers feel more temporal dissonance than managers

Table 7: Study 2 Mean Comparisons

Discussion

The purpose of study 1 was to develop the new measures, 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 remaining, salience probably should be revisited to strengthen its measurement. Temporal congruity still retained four items, so should be fine.

The results in general support the idea that managers and IT workers do use time differently. IT workers are more like owls than managers, and less concerned with deadlines. While this study did not find a difference between IT workers and managers on the temporal congruity measure, it did find a difference in actual temporal dissonance experienced. This can probably be explained by the fact that the congruity is more salient to the IT workers than to their managers. Managers have more power in the relationship, and thus are less concerned with the differences than IT workers are.

The increased cynicism and stress resulting from the increased temporal dissonance felt will reduce the performance of IT workers in general. Also, since many IT projects fail because of undermined motivation and poor working relationships among team members (Nelson 2007), increases in these two dependent variables due to temporal dissonance may well be a cause of some of those failures. 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 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. 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.

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 and cynicism in the IT worker.

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. Repetition with different groups would strengthen the validity of the measure. Also, we only investigated a small portion of the nomological net. Conclusions about causality should be considered with caution, as other models with differing causality will fit the data as well as the proposed model.

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 frame for understanding why time management techniques do not always work, and a possible pointer to their most effective use.

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.

Finally, 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.

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., 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.

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., and Denhardt, R. B. 1988. "Time and Organizations.," *Journal of Management* (14:2), pp. 299-320.

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.

Claessens, B. J. C., Eerde, W. van, Rutte, C. 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.

Conte, J.M., Landy, F.J., and Mathieu, J.E. 1995. "Time urgency: Conceptual and construct development", *Journal of Applied Psychology* (80:1), pp. 178-185.

Conway, C. M., and Limayem, M. 2010. "Adrift in the Sands of Time: A Theory of Temporal Dissonance in the Individual," *Proceedings of the Academy of Management Annual Meeting 2010, Montréal, QC, Canada, 6-10 August 2010.*

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.

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.

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

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*, Stanford: Stanford University 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.

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.

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

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.

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,) McGraw-Hill.

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

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

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.

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*, .

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

Lindquist, J.D., and Kaufman-Scarborough, C. 2007. "The Polychronic—Monochronic Tendency Model", *Time & Society* (16:2-3), p. 253.

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

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

Mcgrath, J. E. 1991. "Time, Interaction, and Performance (Tip) - a Theory of Groups," *Small Group Research* (22:2), pp. 147-174.

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,".

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.

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

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.

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

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.

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*, .

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,*, Russell & Russell.

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

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

The Standish Group. 1995. "The Standish Group Report: Chaos,".

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.

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.