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Identifying new temporal coordination requirements for calendar systems through a temporal structure lens

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ABSTRACT

Temporal structures have been argued to be an important element of business affecting both the processes that are undertaken within an organization and the overall productivity of the organization and its members. As such, organizations should engage in temporal coordination planning in order to ensure that previously ad hoc temporal structures are streamlined and used to enhance and integrate business processes. This research is at the task analysis stage in the development of such temporal coordination systems. Forty interviews with management, exploring the types of temporal structures used in temporal coordination process, were conducted to capture preliminary functional requirements for temporal coordination systems. The temporal structure difficulties uncovered in this research are used to suggest modifications to current emerging electronic temporal coordination systems, e.g., the personal and collaborative electronic calendar systems. We summarize by giving a set of new requirements that can be used by designers to build the temporal system of the future.

1. Introduction

Time is becoming an increasingly important commodity in today's business world. Information technologies have integrated and advanced business processes, dramatically reducing cycle time. Further, there is an increased emphasis for businesses to respond to environmental conditions on a more rapid schedule and to develop solutions following more agile methods (Strode, Luff, Hope, & Link, 2012). Thus, expectations for time to market for new product entries and product modifications are significantly reduced, and competitive advantages for companies often come from time-related efficiencies or constraints that can be placed on others. Time should thus be a very important part of organization theory, yet it has been neglected for decades by researchers (Sonnentag, 2013).

Globalization has increased this temporal intensity so that people today live in a world where a variety of tasks take place in a dynamic temporal context with cyclical and phasic patterns throughout (McGrath, 1990). Ballard and Waller (2008) find that professionals have rhythmic temporal patterns that can be used to help coordinate interactions in a workplace. Individuals are constantly barraged with information and decisions, but have inadequate amounts of time available to absorb, find and utilize all such information when making decisions (DiClemente & Hantula, 2003). People usually develop and rely upon heuristics in order to consume time more efficiently and develop habitual ways to process information and its relation to available time (Pirolli & Card, 1995). People thus fall into patterns and habits that govern how they respond to specific temporal patterns that they constantly phase in their work and personal lives. For example, Swigger, Hoyt, Serce, Lopez, and Alpaslan (2012) find that temporal communication behaviors are associated with project outcomes in complex ways among student global software development teams, and they suggest that temporal coordination mechanisms serve as an important means for understanding the pace and synchronization for the global software development process.

The management field was among the first to recognize the importance of temporal patterns. Research in management has begun to focus on how the organization and structure of time affects corporate performance. The concept of *temporal structures*, the inherent time structures that control the flow of activities within an

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organization, has been of interest for several decades (Montoya-Weiss, Massey, & Song, 2001). Studies have begun to classify these temporal structures and to demonstrate that they can have both negative and positive effects on an organization's performance. However, little research has focused on how temporal coordination tools are able to positively or negatively impact temporal structures within an organization and improve overall performance and efficiency. It is unclear how these initial forays into the classification of temporal structures and their effects on the organization can be accomplished through a technological medium.

The computing field has only begun to take an interest in this temporal structure research. Not surprisingly, the information systems field would be an obvious candidate for capturing and managing such temporality in that this field is interested in the design, adoption and usability of technology. We refer to the management of temporal structures as *temporal coordination*. Although research is only beginning to understand what temporal structures exist and how they impact business processes, it has been suggested that information systems research should take temporality seriously (Boland, Jones, Levina, Orlikowski, & Wagner, 2004). We answer this call by exploring the following research questions through looking into individual professionals' time management behavior and their interactions with calendaring tools.

RQ1: What are the characteristics of temporal structures currently being used by organizations for temporal coordination?
RQ2: What are the limitations of the current temporal structures tools?
RQ3: What are the new design requirements for the development of an ideal temporal coordination system that overcomes the existing limitations?

In light of these research questions, the research presented in this paper gathers data on time management behavior with the purpose of using the difficulties uncovered to present a first set of requirements for the development of temporal coordination systems for businesses with a temporal structure perspective. Such a set of requirements can be used by designers to build future systems that overcome the current limitations. Previous research has shown that the success of new software tools depends on how well the software requirements elicitation is carried out (Klendauer, Berkovich, Gelvin, Leimeister, & Krcmar, 2012) and the direct participation of the users in the user requirement elicitation process (Koh & Heng, 1996). This study provides the first such efforts to explain how temporal coordination tools should be designed to increase the likelihood of positive outcomes and increased efficiencies of users in the management of their respective temporal patterns.

We note that this study is nontrivial because temporal structures are often generated externally or at low levels within individual organizational units. They are also embedded in local cultures, and have ambiguous boundaries. Furthermore, globalization connects units of work that have decidedly different temporal structures bringing about further coordination clashes, including those of time zone and cultural differences. These issues suggest that temporal coordination systems can be used as coordinating mechanisms, both in terms of capturing unknown but important temporal information and in providing decision-making support for setting appropriate temporal guidelines and redesigning existing temporal structures to improve the fluidity of processes.

Our investigation is structured around the relatively loosely defined classifications of time structures developed in prior temporal structure research. We first demonstrate that individuals use a variety of temporal structures, and second, that people have significant difficulty with coordinating temporal structures, especially those that have fuzzy boundaries, involve multiple persons, arise from independent systems or have a complex set of cultural rules embedded in them.

This paper proceeds as follows. The first section above presented the study background. In the second section, we review the existing temporal structure, coordination literatures and calendar tool studies. This is followed by a description of the two sets of semi-structured interviews conducted. Detailed interview coding instructions, coding examples, and coding results are then presented in the next few sections. The final section draws together our theoretical interpretations to illustrate the study findings and design implications on enhancing electronic temporal coordination system design with a temporal structure point of view. Finally, we propose future directions based on this work.

2. Theoretical background

2.1. Temporal structures

Temporal structures have long been used to activate and structure asynchronous differentiation to achieve organizational goals. Temporal structures are a primary concept in organization behavior and organization change (Bluedorn & Denhardt, 1988; Clark, 1985; Orlikowski & Yates, 2002). *Temporal structures* are defined as patterned organization of time used by humans to help them manage, comprehend or coordinate their use of time (Wu, 2009). They provide a foundation that human beings use to construct the regularity of their society, and reduce the uncertainty of human perception of time. For individuals in a workplace, their work time is created by the organization members who establish and regulate the temporal structures.

Individuals in a workplace experience different, regular deadlines, engage in routine activities, and take seasonal vacations. However, it remains unclear how individual professionals respond to these temporal demands and entrainments set up by their organizations. Wu (2009) investigated the relationship between the quality of individual time management and temporal structure usage behavior. Through a large survey, this study demonstrated that temporal structures are an important component of individual time management practices. These individual temporal experiences are a result of the ongoing coordination with a variety of temporal structures, which regulate an individual's time usage, and thus affect collective temporal coordination activities in organizations.

We argue that individual temporal structure usage behaviors help us better understand where ambiguous temporal boundaries are and how individuals handle time conflicts to achieve temporal coordination goals in personal time management practices. This research takes the definitions of temporal structures and relates them to individual time management practices. It is through this temporal lens that we generate new electronic temporal coordination features for improving individual and organizational productivity.

Two key temporal structure categorizations in prior research provide us a solid foundation to further investigate how individuals capture and use their internal and external temporal information and construct their own time management practices, which inherently involve many temporal coordination activities. The first temporal categorization by Blount and Janicik (2001) indicates that temporal structures are composed of three components: (1) *explicit* schedules, sequencing patterns, and deadlines, which are typically