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ABSTRACT

While time is central to the way we work and live our lives, it is often viewed overly simply or overlooked completely. Time is highly complex, polymorphous, socially constructed and context dependent. Time is also experienced differently across cultures, sub-cultures, organisations, teams and individuals. Many researchers have attempted to classify the complexities of time. However, there is no overarching framework which is commonly agreed upon. We reviewed the temporality literature and particularly the existing frameworks which attempt to classify time. This research-in-progress paper uses the well regarded Ancona *et al*., (2001) framework to classify time into three categories: conceptions of time, mapping activities to time and actors relating to time. Guided by this framework, the extant literature on information systems development (ISD) research was reviewed. Preliminary findings were found, conclusions, limitations and future research is also considered.

Keywords

Time, temporality, information systems development, systematic literature review.

INTRODUCTION

No matter the topic, or the context, time is always a prominent, multifaceted and complex concept (Ancona, Okhuysen & Perlow, 2001). Information systems development (ISD) is no exception. In fact, ISD usually takes place in a relentlessly dynamic, complex and unpredictable environment (Abdel-Hamid & Madnick,1990; Benbya & McKelvey, 2006; Cockburn & Highsmith, 2001; Conboy, 2009). In such an environment, time becomes even more critically important (Nanadhakumar, 2002).

Contemporary and emergent ISD literature is filled with temporal characteristics but neglect the complex and subtle nature of time. Time as a construct is related to other constructs for example, in ISD literature *pace* (Vidgen & Wang, 2009), *rhythm* (Sarker & Sahay, 2004), *velocity* (Power & Conboy, 2015), *speed* (Conboy, 2009), *just-in-time* (Lee, 1999), *on-time delivery* (Sarkar, Munson, Sarker, & Chakraborty, 2009)*, completion rates* (Yetton, Martin, Sharma, & Johnston, 2000), *lead time* (Patnayakuni & Ruppel, 2006), *time management* (Nandhakumar, 2002), *planning* (Shmueli Pliskin, & Fink, 2016), *time pressure* (Austin, 2001) *rapid change* (Ramesh, Cao, & Baskerville*,* 2010), *temporal dissonance* (Conway & Limayem, 2011), and *late deliveries* (Austin, 2001) are all illustrations of temporal terms in ISD literature.

Yet, those studying and experiencing ISD conceive time as clock time. This over reliance on clock time overshadows ISD perspectives and theories (Nanadhakumar, 2002). As a result, traditional time management techniques are ill prepared for ISD projects (Nanadhakumar, 2002). This is illustrated by frequent late deliveries of ISD projects with continuous and problematic failure rates (Bartis & Mitev, 2008; Carlton, 2014; Pervan, 1998; Whittaker, 1999). In contemporary and emergent ISD method literature, time has not been studied as comprehensively as it should. Yet, time is the single differentiating factor between ISD methods to date (i.e, speed, sprints, daily stand ups, cycle time, lead time, velocity).

Considering the importance of time in ISD and following numerous calls to research temporality within the context of ISD teams and under dynamic conditions, it has not been explored explicitly or sufficiently in information systems (IS) research (Lee & Liebenau 2000; Saunders & Kim 2007; Waller, Conte, Gibson, & Carpenter, 2001).

Building on the comprehensive temporality framework proposed by Ancona *et al.*, (2001), the aim of this research is to understand the various components of temporality within the context of ISD. For example, clock time is placed in such importance in all ISD projects, but an important question to ask is whether clock time is the best way to conceptualise time in ISD projects. Perhaps other categorises of time would improve ISD project success. This research will examine the concept of temporality within ISD teams and produce a systematic literature review which will give the reader an up-to-date analysis of temporality in ISD. This research contributes to research and practice by identifying any gaps, misconceptions or general conceptual issues in the application of temporal concepts to ISD to date.

This research-in-progress paper describes the research objective, background literature, concept of temporality, research approach to examining time in ISD literature, and preliminary literature review findings.

RESEARCH OBJECTIVE

We aim to address the call from ISD researches which found: (i) time is understudied; (ii) time is dominated by clock time and neglects all other conceptions of time; (iii) ISD is inherently characterised by time but studies which address time explicitly is lacking.

A fundamental motivation for this research is: (i) frequent late deliveries of ISD projects with continuous and problematic failure rates show little signs of improvement; (ii) traditional time management techniques are ill prepared for ISD projects; (iii) those studying and experiencing ISD conceive time as clock time; (iv) clock time overshadows ISD perspectives and theories; (v) time is the single differentiating factor between ISD methods to date (i.e, speed, sprints, daily stand ups, cycle time, lead time, velocity). Yet, in contemporary and emergent ISD method literature, time has not been studied as comprehensively (Ancona *et al.,* 2001 framework) as it should; (vi) no literature review of time in ISD research has previously been published. Thus, we aim to address if the complexity of time is studied in ISD.

The objective of the review is to answer the following research questions:

RQ1   *What has been reported about temporality in ISD in the existing literature?*

RQ1.1   *What component of temporality is being studied?*

RQ2   *How is temporality studied in ISD?*

RQ2.1   *What methodology is used to study temporality?*

RQ3   *How has temporality research contributed to ISD literature?*

RQ 3.1   *What was the contribution to temporality?*

In addition to enhancing findings on the complexity of time within ISD, the review also aims to contribute to conducting information systems systematic literature review methodology. A further contribution will be that of a study which conducts a systematic literature review: (i) where the complexity and subtle nature of time is incorporated into a search strategy; (ii) to find relevant papers; (iii) which are then systematically analysed based on a conceptual framework.

BACKGROUND LITERATURE

Over the past twenty-five centuries, the complexities of time have been studied in many disciplines such as psychology (Friedman, 1990), physics (Einstein, 1905; Hawking, 1993), and anthropology (Durkheim, 1915). There has been a renewed interest in time and timing in organisational theory (Crossan, Cunha, Vera, & Cunha, 2005; Kamp, Lambrecht Lund, & Søndergaard Hvid, 2011; Roe, 2008). This can be attributed to the emergence of global businesses and the urgent nature of production demands (Orlikowski & Yates, 2004). In organisational studies, one of the first and most famous studies to explicitly concentrate on time was by Taylor (1911). Taylor revolutionised the way in which managers view time and much of his findings can still be seen across organisations today (Guerrier, 2016). However, somewhat remarkably, very little research exists on time in an organisational setting over the years (Ancona *et al*., 2001). Temporality studies should have been included in organisational theory; however, it has remained hidden for decades (Sonnentag, 2012). However, in recent years, organisational researchers have begun acknowledging the benefits of analysing organisations through a temporal lens (Ancona *et al*., 2001, Orlikowski & Yates, 2004; Sonnentag, 2012).

Time underpins much of what we think about and do in IS. This is also reflected by the interest of time and IS in organisational work (Saunders & Kim, 2007; Sarker & Sahay, 2004; Nandhukumar, 2002; Lee & Liebenau, 2000; Lee, 1999). IS researchers regularly stress the time benefits of IS within the organisation. However, IS researchers are slow to address this polymorphous, multi-dimensional, complex concept that is often masked subtlety and over-simply in IS research (Saunders & Kim, 2007; Nandhakumar, 2002). As a result, research on time in IS is largely under-explored (Lee & Liebenua, 2000) and there is a need for more research within the area (O'Riordan, Conboy & Acton, 2013; Saunders & Kim, 2007; Shen, Lyytinen & Yoo, 2014). The one-dimensional focus of clock time in IS research means that temporal synonyms such as speed, pace, velocity, cost of delay, ignore the complexity around time which permeate IS research. A multi-dimensional view of time would consider the perception of time and an actor's experience of time in IS teams (Shen *et al*., 2014). The need to produce temporality studies in IS which go beyond the simple, one dimensional view of linear clock based time is ongoing (O Riordan *et al*., 2013).

ISD is a time pressure and highly complex environment where regular delays occur (Austin, 2001). There are frequent innovative ISD methods introduced into the industry to solve delays. The rationale for this ever-emerging series of ISD methods is time. For example, faster time to market. The timing and sequence of activities and not the actual activities themselves have been to some degree, the differentiation between methods. It is not the activities but the length of time and sequence of those activities that differentiate various methods such as waterfall, rapid development, agile, lean, flow and continuous development from each other. For example, agile methods promote an ISD environment where customer requirements can be changed more quickly than traditional methods (Dingsøyr & Lindsjørn, 2013).

TEMPORALITY

Temporality refers to an individual's experience of time (Caldas & Berterö 2012), which includes our relationship to time (Heidegger, 1927), and how we react to time (Fraisse, 1963). There have been explicit attempts to add to temporality theory within the past few decades (Ancona *et al*., 2001; Mosakowski & Earley, 2000; Orlikowski & Yates, 2002; Standifer & Bluedorn, 2006). However, there is a lack of an overarching temporal framework. There are several attempts to create an overarching theory on time, however no theory of time is universally accepted.

In organisational literature, several temporal frameworks have emerged over the last four decades, mostly within organisational research (e.g., Bluedorn & Denhardt, 1988, Ancona et al., 2001, Mosakowski & Earley, 2000, Orlikowski & Yates, 2002, Sonnentag, 2012). Scholars have used a range of temporal dimensions to describe temporality in organisations. There are frameworks (Bluedorn & Denhardt, 1988; Ancona *et al.,* 2001) which consider the full extent of time and all its complexity. These studies not only consider all temporal dimensions but also categorise them into an applicable structure. The Bluedorn & Denhardt (1988)) framework classifies time into three categories; social time, mathematical time, and economic time. Ancona *et al*., (2001) classifies time into three interrelated categories; conceptions of time, socially constructed time, and actors relating to time. However, a concept analysis reveals that there are inconsistencies with the temporality literature that exists. There are inconsistent definitions and use of temporal terms in these frameworks.

There are studies which examined temporal dimensions within a problem. These temporal dimensions vary. Schriber & Gutek (1987) examined temporality within organisational culture and found thirteen main temporal dimensions; time boundaries between work and non-work, sequencing of tasks, punctuality, allocation, awareness, synchronization and coordination, variety versus routine, intra-organizational time boundaries, future orientation, schedules and deadlines, work pace, autonomy of time use, and quality versus speed. Lee & Liebenau (2000) identified six temporal dimensions that can be used to evaluate the temporal effects of IS: duration, sequence, temporal location, deadline, cycle and rhythm. Zerubavel (1981) examined temporality in organisations and found four temporal dimensions: sequential structure, duration, temporal location and rate of recurrence. Ancona *et al.*, (2001), Schriber & Gutek (1987), Lee & Liebenau (2000), and Zerubavel (1981) all examined temporality within an organisational context. Schriber & Gutek (1987), Lee & Liebenau (2000), and Zerubavel (1981) contributed to temporal dimensions. However, Ancona *et al.*, (2001) framework is unique as it provides a holistic classification of temporal dimensions.

Classification of time

This study uses the Ancona *et al.*, (2001) framework (Table 1) to firstly classify time and secondly to understand what ISD literature on time exists to date. Ancona *et al.*, (2001) reviewed the literature surrounding temporality within the areas of organisational theory, sociology, social psychology, and anthropology and developed a framework to classify time. The framework has three categories called conceptions of time, mapping activities to time and actors relating to time (Ancona *et al.*, 2001). The framework was chosen because it is a well-regarded classification of time (Shen *et al.,* 2014). Shen *et al.*, (2001) also chose it because it "synthesizes a large swath of temporal concepts across diverse areas of temporal study and provides a common organising framework for these temporal constructs and variables". It is also an easily applied structure that can be used as a lens to examine teams (Shen *et al.*, 2014, p3). Thus, it is suited to this research on ISD.

Category	Subcategory	Sample Variables
Conceptions of time	Types of time	Linear time, uniform time, cyclical time, subjective time, event time
	Socially constructed time	Work organization (nine-to-five workdays, work time and family time), celebrations (Passover and/or Easter), time as a renewing cycle, time as linear continuity
Mapping activities to time	Single activity mapping (a)	Scheduling, rate of completion, duration
	Repeated activity mapping (aa)	Cycle, rhythm, frequency, interval
	Single activity transformation mapping (aa')	Life cycles, midpoint transitions, jolts, interrupts, deadline behavior
	Multiple activity mapping (ab)	Relocation of activities, allocation of time, ordering, synchronization
	Comparison and meshing of activity maps (ab) versus (aa)	Entrainment, patterning, temporal symmetry
Actors relating to time	Temporal perception	Experience of time, time passing, time dragging, experience of duration, experience of novelty
	Temporal personality	Temporal orientation, temporal style

Table 1. Classification of Categories and Subcategories, with Sample Variables (Ancona *et al.,* 2001)

Conception of Time

The framework identifies three categories; conceptions of time, mapping activities to time and actors relating to time. Each classification of time is now discussed in turn. A conception of time can be created by an individual. For example, an employee in an organisation can conceptualise their own view of time (Medlin & Saren, 2012). There are different types of time such as linear time, uniform time and cyclical time. However, the most popular and widely cited types of time are clock time and event time (Mosakowski & Earley, 2000). Each society will conceptualise time differently. For example, some may use clock-based time whereas others may use event-based time (Mosakowski & Earley, 2000). Clock time versus event time can be associated with the Newton (1871) Vs Einstein (1945) debate. Newton perceived time as absolute and Einstein perceived time as relative. Still, individuals can experience multiple types of time at once (Ancona *et al*., 2001). Time is also revealed as a socially constructed phenomenon (Ancona *et al*., 2001; Saunders *et al*., 2004). Even within these groups, time can be used in a way which is appropriate to the sub group (Ancona *et al.,* 2001). This means there can be different dimensions of time within a society (Saunders *et al*., 2004).

Mapping activities to Time

The main aim of mapping activities to time is to get a valid analysis of what happens over time during an activity (Roe, 2008). This category explains that events and activities can be mapped to time. Mapping activities to time explains when an activity will begin, how long it may take and any fluctuations or patterns over the interval (Ancona *et al*., 2001). Single activity mapping maps a single activity to a time continuum (Ancona *et al*., 2001). Single activity mapping entails the examination of a single event which is not usually repeated once the activity has taken place. Repeated activity mapping has been researched far less than single activity mapping. Repeated activity mapping is where an activity is repeated on multiple occasions and is mapped to time. Single activity transformation mapping occurs when, during an activity, the old activity transforms into the new activity, changing the form of the activity (Ancona *et al.,* 2001). The single activity transformation mapping is catered for one single event. In multiple activity mapping, activities are examined in relation to each other. The primary concern for multiple activity mapping is allocating the correct amount of time towards the multiple activities (Ancona *et al*., 2001). Comparing multiple activity mapping is used to understand the differences and similarities in temporal characteristics. Not all activities have the same temporal characteristics.

Actors relating to time

Actors relating to time explain the actors which are involved in the previous two categories. Temporal perception variables are used to reveal how actors perceive and act with regard to the continuum of time. The actors may refer to the individual, team or the organisation (Ancona *et al*., 2001). The perception of time is different among the different cultures around the world (Mosakowski & Earley, 2000). Individuals also have their own temporal personality (e.g., when an individual schedules his/her tasks). They will follow their own temporal personality while doing so (Avnet & Sellier, 2011). Although our perception of time is influenced by our culture, it is also formed by our own individual temporal personality. A temporal personality is unique to the distinctive individual and the way in which an individual understands and experiences time will be exposed through their actions (Ancona *et al*., 2001).

RESEARCH METHOD

General temporality and time classification frameworks were examined. Having chosen the Ancona *et al.,* (2001) framework because of its broad application and easily applied structure, a number of pilot tests were carried out. We used a systematic literature review approach and a brief analysis of temporal research in ISD was of a primary concern. From that, some opening early stage preliminary findings were exposed.

In conducting our literature review, we chose an efficient scientific method; a systematic literature review. A systematic literature review is a "means of identifying, evaluating and interpreting all available research relevant to a particular research question, or topic area, or phenomenon of interest" (Kitchenham, 2004:1). This type of review offers a high quality (Dybå & Dingsøyr, 2008), transparent and replicable review (Leidner & Kayworth, 2006). This method offers the capability of summarising a large quantity of research publications (Fink, 2005), for studies which aim to address a clearly formulated question (Petticrew & Roberts, 2006). Therefore, a systematic literature review was chosen rather than a narrative literature review for four reasons: (1) our study aimed to answer a specific research question; (2) our area of study will generate a large amount of literature; (3) our intention was to systematically extract

relevant temporal references from the publications in a transparent form; (4) the rigour and replicability it offers which leads to an unbiased scientific paper.

Systematic literature reviews originated in health science (Fink, 2005) and have been applied in many diverse domains including supply chain management (Gimenez & Tachizawa, 2012), nursing (Brady Germain & Cummings, 2010), organisational management (Crossan & Apaydin, 2010), marketing (Antunes & Moreira, 2011) and air transport (Ginieis et al., 2012). Within information systems, systematic literature reviews have been published within the top journals (Grahlmann, Helms, Hilhorst, Brinkkemper, and Van Amerongen, 2012; Lavranos, Kostagiolas, Korfiatis, & Papadatos, 2015). However, not to a large extent. Two reasons for this neglect has been that IS researchers are unaware of the need for a rigorous and systematic literature review (Levy & Ellis, 2006) and many are unsure about the methodology involved in conducting a systematic literature (Okoli & Schabram, 2010).

Systematic literature review guides have also been developed in a variety of different domains such as social science (Petticrew & Roberts, 2006), software engineering (Kitchenham & Charters, 2007) and IS (Leidner & Kayworth, 2006; Levy & Ellis, 2006; Okoli & Schabram, 2010; Webster & Watson). IS research methods are different from health sciences methods and require a specific systematic literature review guide (Okoli & Schabram, 2010). Within IS, bespoke systematic literature reviews were developed in response to the shortage of appropriate guides which suit the multidiscipline domain of IS. The domain is made up of social science, business, and computing science disciplines (Okoli & Schabram, 2010).

We followed the systematic literature review approach based on work by Kitchenham & Charters (2007), Levy & Ellis (2006), Okoli & Schabram (2010) and Webster & Watson (2002). The foundation of our guide was taken from an IS guideline developed by Okoli & Schabram (2010). However, we drew from similar work by Kitchenham & Charters (2007), Levy & Ellis (2006) and Webster & Watson (2002) to strengthen our scientific review.

Webster & Watson (2002) was one of the first attempts to create a systematic literature review guide within the IS domain. This work has contributed to further systematic literature review guide within IS such as Levy & Ellis (2006) and Okoli & Schabram (2010). However, it lacks the depth Levy & Ellis (2006) and Okoli & Schabram (2010) can offer. Webster & Watson (2002) lacks rigour and explanation in which the novice researcher needs. Hence, Levy & Ellis (2006) and Okoli & Schabram (2010) were chosen to add strength and further thorough guidelines to the systematic literature review process.

Levy & Ellis (2006) developed a set of guidelines for IS doctoral researchers, early stage researchers and IS researchers who have difficulties completing a successful literature review. Levy & Ellis (2006) took some features from Webster & Watson (2002) such as the backward and forward search feature. However, it offers a more in-depth guide tailored for the needs of the IS doctoral researchers.

Okoli & Schabram (2010) developed a bespoke methodological approach for IS researchers which offers a guideline created from contributions within software engineering (Kitchenham & Charter, 2007), social sciences (Petticrew and Roberts,2006), health sciences (Fink, 2005), management and organization science (Rousseau *et al*., 2008) IS (Levy & Ellis, 2006; Webster & Watson,2002). This is an exhaustive guideline as it is adapted best practices from several other domains. It offers a balanced approach of both qualitative and quantitative methods. This differs to Levy & Ellis (2006) which is primarily qualitative based. This guide has more depth than Levy & Ellis (2006) and focuses on guidelines for areas that previous methodologies have neglected.

Kitchenham (2004) developed a lengthy and thorough procedure for performing literature reviews. These guidelines were progressed by Kitchenham & Charters (2007). Although Kitchenham & Charters (2007) is an extensive and exhaustive guide, it was created for the software engineering domain. However, software engineering overlaps with the IS domain and due to the guides large application within other fields such as business process management (Maita *et al.,* 2005), marketing (McHugh & Domgan, 2010), and nursing (Beraldi & Abades, 2014), it has been chosen for the unique exhaustive contribution it can offer. One of its unique contribution is the protocol feature, in which we implemented for this paper.

We followed an eight-step guideline which is required for completion of a systematic literature review. Although any of these steps can be followed by researchers who complete a narrative literature review, following all steps are essential to conduct a scientifically rigorous systematic literature review (Okoli & Schabram, 2010). This guide is

based on (Okoli & Schabram, 2010) but draws from similar best practices from three other systematic literature review guides; Kitchenham & Charters (2007), Levy & Ellis (2006) and Webster & Watson (2002).

A keyword strategy (Table 2) was developed based on the temporal terms used in several temporality frameworks (Ancona *et al.,* 2001; Bluedorn & Allen, 1988; Kavanagh & Araujo, 1995; Lee &Liebenua, 2000; Mosakowki & Early, 2000; Sonnentag, 2012). They keyword strategy was applied to Association for Information Systems (AIS) senior scholars' basket of IS journals and top two IS conferences (Table 3). The largest, most extensive and information systems-specific databases were chosen (Table 4). The research questions (Table 5) were used to develop the inclusion (Table 6) and exclusion (Table 7) strategy. The data extraction (Table 8) and quality assessment (Table 9) was used to develop preliminary findings.

Keyword strategy
TOPIC: ((system* OR software*)) AND TOPIC: ((method* OR design* OR develop* OR practice* OR project* OR agile* OR scrum* OR "extreme programming" OR xp OR feature* OR crystal* OR lean* OR flow* OR team* OR technique* OR approach*)) AND TOPIC: ((tim* OR temporal* OR *cycl* OR schedul* OR rate* OR duration* OR rhythm* OR frequen* OR interval* OR jolt* OR interrupt* OR deadline* OR *sync* OR order* OR pattern* OR entrain* OR novel* OR "relocation of activities" OR "mid-point* transition*" OR "midpoint* transition*" OR clock* OR calendar* OR speed* OR slow* OR *prior* OR routine* OR fast* OR year* OR event* OR day* OR plan* OR monochronic* OR polychronic* OR pace* OR lag* OR urgen* OR sequen*))

Table 2. Keyword Strategy

Conference/Journal	Acronym
European Journal of Information Systems	EJIS
Information Systems Journal	ISJ
Information Systems Research	ISR
Journal of the Association of Information Systems	JAIS
Journal of Information Technology	JIT
Journal of Management Information Systems	JMIS
Journal of Strategic Information Systems	JSIS
Management Information Systems Quarterly	MISQ
International Conference on Information Systems	ICIS
European Conference on Information Systems	ECIS

Table 3. Association for Information Systems (AIS) Senior Scholars' Basket of IS Journals and Top Two IS Conferences

No.	Database
(1)	Association for Information Systems
(2)	Scopus
(3)	Web of Science

Table 4. Literature Databases

ID	Research Question	Aim
RQ1	What has been reported about temporality in ISD in the existing literature?	To provide a comprehensive review of time in ISD literature
RQ1.1	What component of temporality is being studied?	To establish what components of time are being studied within ISD literature
RQ2	How is temporality studied in ISD?	To identify how research on time in ISD is carried out
RQ2.1	What methodology is used to study temporality?	To establish what methodology is used in carrying out research on time in ISD literature
RQ3	How has temporality research contributed to ISD literature?	To identify the contribution temporality has made to ISD literature
RQ 3.1	What was the contribution to temporality?	To categorise the contribution of temporality in ISD literature

Table 5. Research Questions

No.	Inclusion strategy
(1)	Each study should relate to one or more of our research questions
(2)	Each study should fall into the top eight IS journals and the top two IS conferences
(3)	Each study should focus on temporality in ISD
(4)	Each study should be empirical, theoretical, conceptual, literature review or experimental
(5)	Each study should be published between 2000 and 2016
(6)	If the study has been published in more than one journal or conference, the most recent version of the study is included

Table 6. Inclusion Strategy

No.	Exclusion strategy
(1)	Duplicate articles will be excluded
(2)	Papers not written in English will be excluded
(3)	Lesson learned, research in progress, editor's reports and experience reports will be excluded
(4)	Papers which use students as the sample study will be excluded

Table 7. Exclusion Strategy

No.	Data extraction	Related RQ
(1)	What component of temporality is being studied?	RQ1
(2)	What methodology was used to study temporality?	RQ2
(3)	What was the contribution to temporality?	RQ3
(4)	Research setting	Overview
(5)	Article title	Overview
(6)	Author	Overview
(7)	Year	Overview
(8)	What ISD methodology does this cover?	Overview
(9)	Classification of study type	Overview
(10)	Source	Overview

Table 8. Data Extraction

ID	Quality Question
Q1	Is this a research paper?
Q2	Is there are a clear statement of the aims of the research?
Q3	Is there an adequate description of the context in which the research was carried out?
Q4	Was the research design appropriate to address the aims of the research?
Q5	Was the recruitment strategy appropriate to the aims of the research?
Q6	Was there a control group with which to compare treatments?
Q7	Was the data collected in a way that addressed the research issue?
Q8	Was the data analysis sufficiently rigorous?
Q9	Has the relationship between researcher and participants been considered to an adequate degree?

Table 9. Quality Assessment questions (source: Dybå and Dingsøyr, 2008)

PRELIMINARY FINDINGS

While the systematic literature review has not been fully conducted to date, some notable findings have emerged. Each finding is now discussed in turn. Firstly, preliminary findings associated with general temporality are summarised. Then, preliminary findings associated with each category of time is discussed in Table 10.

Preliminary Findings Associated with General Temporality	
Time in ISD is studied implicitly rather than explicitly	ISD literature ignores the depth and complexity of time, as depicted by Ancona *et al.*, (2001). Considering ISD methods such as agile and flow are time focused, there is a lack of research which explicitly focuses on time in ISD. Analysis of the literature revealed that time is implicitly referenced using temporal variables. Temporal variables can be found in the majority of ISD literature. For example, *pace* (Vidgen & Wang, 2009), *rhythm* (Sarker & Sahay, 2004), *velocity* (Power & Conboy, 2015), *speed* (Conboy, 2009), *just-in-time* (Lee, 1999), *on-time delivery (*Sarker *et al.,* 2009*), completion rates* (Yetton *et al.,* 2000), *lead time* (Patnayakuni & Ruppel, 2006), *time management* (Nandhakumar, 2002), *planning* (Shmueli *et al.,* 2016), *time pressure* (Austin, 2001), *rapid change* (Ramesh *et al.,* 2010), *temporal dissonance* (Conway & Limayem, 2011), and *late deliveries* (Austin, 2001). Collectively, these temporal variables are researched in some form, in every ISD method. They are used in the research when describing the enabling of speed or used as a measurement. The issue is that despite their importance in ISD, they are never studied in their own right but rather as a variable or indirect measurement of some broader non-temporal study.
Preliminary Findings Associated with Conceptions of Time	
One dimensional view of the concept of time	Ancona *et al.,* (2001) uses over thirty-five sample variables of time. Of these, a linear objective form of time is only used once. The analysis of the ISD literature revealed that very little research has been focused on the other complex temporal variables of the framework. However, while there are some references towards the other temporal variables e.g., *rhythm* (Sarker & Sahay, 2004) and *interruptions* (Xia & Lee, 2005), most are measured quantifiably in hours and days. This means that the vast majority of literature focuses on clock time. A Nandhakumar (2002) study similarly revealed that IS research largely ignores time and within ISD projects, time is perceived as clock time. Furthermore, the Nandhakumar (2002) study revealed that ISD perspectives and theories are also mainly considered to be clock-based time. Thus, ISD research has failed to consider time as a complex phenomenon.
Preliminary Findings Associated with Mapping Activities to Time	
Lack of research involving mapping activities to time	There is a rich body of knowledge around mapping activities to time. The literature review revealed that ISD studies have mapped activities to time e.g., *pace* (Vidgen & Wang, 2009), *rhythm* (Sarker & Sahay, 2004), and *velocity* (Power & Conboy, 2015). However, the literature reveals many gaps. Of the ISD literature which maps activities to time, they are studied implicitly or are a variable within a broader study. The literature also revealed that there is a focus towards a single activity mapping to time. Studies are conducted around one task or one deadline. However, in reality, most teams are involved in a portfolio of projects at once. One reason for this lack of research in mapping activities to time is that researchers may not have access to organisations over a long period of time. This makes it difficult for researchers who want to apply a temporal lens over the long term in order to include temporal variables such as pacing styles, duration and sequencing (Ancona *et al.,* 2001).
Preliminary Findings Associated with Actors Relating to Time	
Lack of research involving actors relating to time	The literature review revealed that ISD literature has examined ISD methods but also how these methods of practice have been adapted (Fitzgerald, Harnett, & Conboy, 2006; Wang *et al.,* 2012). However, the literature rarely looks at how these methods of practice study actors relating to time. Temporal individual differences are constantly overlooked. The actors experience and relationship to time is also under-explored in ISD. For example, there is a lack of ISD studies which address experience of time, the passage and flow of time, time pressure, temporal personality and temporal orientation. As with the other classifications of time, time is studied implicitly and usually part of a study which focuses on an alternative focus.

Table 10. Preliminary Findings

CONCLUSION AND FUTURE RESEARCH

The literature review to date shows that ISD research: (i) lacks explicit studies on time; (ii) adopts an overly simplistic and one-dimensional view of time; (iii) only focuses on single activities e.g., a deadline and neglects the fact that teams will be involved in multiple tasks and projects at once; and (iv) lacked studies which considered the actors relating to time in ISD. The next research phase will include a more in-depth literature review on time in ISD. This upcoming literature review will expose a fuller, truer and deeper analysis of ISD studies on time. The review will firstly include an analysis of explicit studies on ISD time where temporal constructs are present and are the focus of study. Secondly, the review will assess ISD research where time is implicit and subtly referenced. Findings will be expanded and classified into each temporal category and within each subcategory. A limitation of the study is that our systematic literature review does not include journal and conference papers which were outside of our sampling criteria. The full systematic literature review aims to: (i) identify any misconceptions or general conceptual issues in the application of temporal concepts to ISD to date.

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