Time and Organizational Learning: A Review and Agenda for Future Research

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This paper examines the time dimensions of organizational learning. While several recent studies have addressed aspects of time in relation to organizational learning, the topic of time has received little attention in reviews of the field, and this promising domain of research is fragmented. The objective of this paper is to bring these dispersed conceptualizations and findings together and to provide a more solid conceptual foundation for the time dimensions of organizational learning as a new research avenue. Three sets of mechanisms are discerned: concerning time as duration; the timing of organizational learning; and the role of the past, present and future in organizational learning. Each of these perspectives offers unique insights, which when integrated can help map new directions for future research.

Introduction

Organizational learning (hereafter OL) has been a key topic in the field of organization and management over recent decades (Argote and Miron-Spektor 2011). Prior research has increasingly attended to the dynamics of OL, investigating underlying subprocesses (Crossan *et al*. 1999; Dyck *et al*. 2005), its social and political dynamics (Antonacopoulou and Chiva 2007; Lawrence *et al*. 2005), and its embeddedness in practices (Brown and Duguid 1991; Nicolini *et al*. 2003). In this paper, we advance inquiry into OL dynamics by integrating and extending research on time aspects of OL and thereby provide new directions for the field of OL.

Time is a fundamental dimension of human existence and organizational life that our theories need to incorporate in basic assumptions, concepts and mechanisms (Adam 1990; George and Jones 2000; Langley *et al*. 2013). Time is implicitly incorporated in most research on OL, because learning involves improvement and progression over time (Lervik *et al*. 2010). Recently, an increasing number of studies have explicitly addressed aspects of the role of time in OL (e.g. Berends and Lammers 2010; Hernes and Irgens 2013; Madsen and Desai 2010). These studies indicate that if we are to understand the dynamics of OL more fully, we need to pay more attention to time as a dimension of the learning process from multiple perspectives. Yet, existing studies have focused on different temporal aspects of OL without fully conceptualizing and integrating the domain, or even without theorizing time at all.

We note specifically that, hitherto, most reviews of the OL literature did not deal explicitly with the topic of time (e.g. Argote 2011; Dodgson 1993;

Easterby-Smith 1997; Easterby-Smith *et al.* 2000; Fiol and Lyles 1985; Huber 1991; Karataş-Özkan and Murphy 2010; Levitt and March 1988; Örtenblad 2002). A few reviews devote some attention to the role of time, but these are limited in the scope of temporal issues addressed (Argote and Miron-Spektor 2011; Bapuji and Crossan 2004, p. 412; Miner and Mezias 1996, p. 94; Weick and Westley 1996, p. 448). As a consequence, the growing body of work that explicitly deals with the role of time in relation to OL is still fragmented.

We feel that systematic understanding of the role of time in OL is a critical priority, because it supports an appreciation of the implications of changes in temporal patterns notable as a key feature of current industries and societies. The dynamics in environments change as a sign of our times, presenting organizations with shorter product life cycles; fast diffusion of information due to improved information technologies; coordination across time zones due to globalization; and increasing productivity demands as organization members are expected to do more in less time. Simultaneously, organizations have to anticipate long-term trends such as natural resource depletion and respond rapidly and promptly in time-based competition (Eisenhardt and Brown 1998; Stalk and Hout 1990).

Such changes in temporal patterns render environments more dynamic and, therefore, call for OL to adopt both a strategic and an operational role. Organizational learning helps organizations to enhance their practices and to improve their prospects in dynamic and competitive environments (Argote 2011; Cyert and March 1963). However, increased environmental dynamics also pose challenges to OL. At the most basic level, learning when little time is available may be a source of problems rather than solutions (e.g. Rahmandad 2008). Hence, organizations need not only to respond to the dynamics of the environment, but to support the development of learning practices suitable to the time and space in which they take place (Antonacopoulou and Sheaffer 2013).

The objective of this paper, therefore, is to integrate current findings and conceptualizations of time aspects of OL and to identify avenues for future OL research. We use existing theory on time to conceptualize prior research on OL, drawing in particular upon Adam's (2000, 2008) idea of timescapes, which suggests that time is not a simple, unidimensional phenomenon, but instead it is complex and multidimensional. We incorporate three core dimensions of time from the timescape perspective: (1) time as duration; (2) timing; and (3) temporal modalities (past, present and future). Using these timescape elements, we distill three sets of mechanisms from prior studies: the duration of time, which can be an opportunity and sometimes a threat for OL; timing, which can give rhythm to OL and make it timely and synchronized; and recurrent and active sense-making of temporal modalities (past, present and future), which offers key mechanisms of OL. Besides conceptualizing and reviewing previous work along these lines, we also outline an integrated perspective on OL as situated in time that points to connections between dimensions, and we indicate directions for future research.

The remainder of this paper is structured in four sections. Following the introduction, the first section introduces theories of time in organizational life, providing a conceptual foundation for our review. The second section explicates the approach of our review of the OL literature and organizes findings from this review according to the three themes noted above. For each of these themes, we also offer directions for future research. The final sections outline a perspective on the integration of time dimensions in relation to OL and discuss implications for future OL research.

Time in organizational life

The field of organization studies has increasingly attended to the role of time in organizational life (Ancona *et al.* 2001; Antonacopoulou and Tsoukas 2002; Hernes *et al.* 2013). Scholars have created a broad range of conceptualizations and typologies of time (Adam 1990; Bakken *et al.* 2013; Mosakowski and Earley 2000), indicating that time is a multifaceted concept. To capture multiple facets of time, we build on Barbara Adam's (1998, 2000, 2008) timescapes concept. Based upon a critical review of time conceptualizations across the social and natural sciences (Adam 1990), she introduced the idea of timescapes to indicate that multiple dimensions of time may simultaneously be present as in a complex landscape, not neatly ordered as in a single distinction or continuum (Adam 2000, 2008). We organize this review around three of the dimensions discerned by Adam (2008): duration, timing and the temporal modalities of past, present and future. These three dimensions were also offered by George and Jones (2000) as three of the key dimensions to be

incorporated in organization and management theories and enabled us to capture the literature on OL in relation to time.

The first dimension of time that we consider is duration, which refers to the degree of expansion in time (Adam 2000, p. 136). It concerns time as something that has a length that can be expressed in terms of a particular timeframe. Time as duration can be measured by clocks and calendars, but also by natural cycles, and has sometimes been labeled as objective time or natural time. It is with regard to this dimension of duration that processes unfold 'over time'. Duration is closely related to speed, because speed concerns the amount of progression or change relative to duration (e.g. distance travelled in an hour). In the management and organization literature, this dimension of time as duration is omnipresent: for example, as the time that a company has been in operation since its establishment, and the development time of new products.

The second dimension of time that we consider is timing. The dimension of timing concerns *when* events occur or actions are undertaken, in relation to other actions and events. Thus, whereas duration concerns the length of time, timing concerns at what moment in time something occurs. Timing also covers the rhythm, timeliness and synchronization of actions and events, as these concepts concern when events occur and how they are related to each other. When something occurs – its timing – can be indicated by clocks and calendars (clock time) and by relation to meaningful events (event time) (Ancona *et al*. 2001; Bluedorn and Denhardt 1988). The timing of organizational routines, for example, may be triggered by events (e.g. emergency evacuation procedures) or by clocks and calendars (e.g. annual reporting).

The third dimension of time concerns the temporal modalities of past, present and future. Whereas timing concerns the specific moment at which something occurs (defined in relation to other events or an instrument such as a calendar), the temporal modalities concern how a person's experience at any moment extends from the present into the past and into the future. At one particular moment, actors may simultaneously consider the past, present and future, and experience them as a continuity (Emirbayer and Mische 1998; Mead 1932), thus constituting a 'threefold present'. The temporal modalities have also been labeled as 'inner time', which 'allows us to relive the past and prelive the future in the present' (Huy 2001, p. 608). Several key concepts in management and organization research draw upon the temporal modalities of past, present and future. For example, the notion of retrospective sensemaking concerns how actors draw upon the past when they make sense of situations (Bluedorn 2002; Weick 1995), and the idea of planning concerns how actors anticipate and prepare for the future (Das 2004).

The dimensions of time are interwoven in actual processes. Adam (1990, p. 67) noted that 'we are not dealing with clear-cut divisions and isolatable principles that exist parallel to each other, but with aspects that interpenetrate and implicate each other'. How the dimensions are involved in specific organizational processes is influenced by temporal structures (Orlikowski and Yates 2002). Temporal structures coordinate how time is used in organizations and are enacted in organizational practices. These considerations have guided our research approach to studying time in relation to OL. We discuss this next.

Time in organizational learning

Methods

To create this review, first a systematic search was undertaken using ISI Web of Science, combining 'organizational learning' and 'tim*' or 'temp*' as search terms. We repeated this with 'learning organization' instead of 'organizational learning', because the learning organization concept has been linked with OL by both scholars and executives, and deals with similar issues, albeit in a more prescriptive than descriptive orientation (Tsang 1997). This resulted in slightly over 350 hits, which we evaluated using the following criteria: (a) we excluded the many papers that referred to 'time' in the abstract without analyzing time in relation to OL; (b) we also excluded the majority of studies that referred to improvements over time as a consequence of OL without theorizing the mechanisms through which time influenced these improvements; (c) we included all relevant studies from organization and management journals, yet focused only on those studies from other domains that had time as an explicit and core element and offered additional insights. We incorporated both empirical and conceptual studies in the review, to include established findings, but also emergent theorizing. This resulted in a set of 30 papers that analyzed OL in relation to aspects of time. About half these papers were concerned in some form with time as duration, whereas the others

Table 1. Distribution of publications over time intervals

Years	Number of publications
1986–1990	5
1991–1995	8
1996–2000	10
2001–2005	18
2006–2010	18
2011–[a]	16

[a]Until October 2013, including advance online publications.

Table 2. Distribution of publications over journals

Journal[a]	Number of publications
Organization Science	16
Management Learning	9
Management Science	9
Strategic Management Journal	6
Journal of Management Inquiry	5
Administrative Science Quarterly	3
Futures	3
Journal of Management Studies	3
Academy of Management Journal	2
Harvard Business Review	2

[a]Excluding journals with only one selected publication.

were concerned with timing and the temporal modalities of past, present and future.

To extend the set of relevant publications, we deployed a snowball approach by tracing citations backwards and forwards (Greenhalgh and Peacock 2005), and relied on more extensive searches through Google Scholar and Web of Science. First, we incorporated papers cited in the few OL reviews that touched upon time (Argote and Miron-Spektor 2011; Bapuji and Crossan 2004, p. 412; Miner and Mezias 1996, p. 94). Thus we added another 11 publications to the review, which were largely limited to the time as duration perspective. Second, we traced references from papers already included in the set, and citations to key papers. Third, we used the same search terms in Google Scholar, thereby also identifying papers published online before print. Fourth, we returned to the Web of Science with additional search terms gathered from the emerging review including 'past', 'future', 'rhythm', 'speed', 'synchronicity', all in combination with 'organizational learning'. From these additional searches, we included only the journal articles, books and book chapters that met the criteria that we applied in our search of Web of Science, and that offered additional insights or additional evidence beyond the studies already identified. These actions resulted in the inclusion of 34 additional publications in the review.

As a result, 75 publications have been incorporated in this review. Table 1 shows how these publications are distributed over time intervals, indicating how attention has been increasing over the years. Closer inspection showed that research interest really took off from 1999 to 2000 onwards, which explains that most earlier reviews of OL missed time as a significant topic. Table 2 presents an overview of the journals in which the selected articles were published.

Our analytical approach resembled the inductive process of theory building as applied in qualitative research (Locke 2001). Initial reading of the literature established that relevant publications could be captured by the three dimensions of duration, timing and the temporal modalities of past, present and future. Because most publications' assumptions on time were implicit, we determined for each publication for which of the three dimensions it was relevant; only a few publications were relevant for more than one theme. Within these subsets of findings, we discerned mechanisms by which time dimensions influenced OL and we structure findings around these mechanisms. Finally, we identified underdeveloped areas and outlined an integrative perspective.

In our inductive theorizing we took an inclusive perspective on OL, building on three widely shared assumptions. First, we view OL as a process that unfolds over time. Second, OL involves the interaction of doing and thinking, be it interwoven as they are embedded in social practices (Antonacopoulou 2006), or more sequentially as outcomes of prior actions are used to generate insight, which can be applied again in later actions (Gavetti and Levinthal 2000). Third, OL has a social dimension, because it stretches across individuals and groups that interact in an organizational context with associated power dynamics. These assumptions underpin, for example, the 4I model of OL (Crossan et al. 1999; Lawrence et al. 2005) and the practice-based perspective on OL (Brown and Duguid 1991; Nicolini et al. 2003), but are also compatible with models of experiential learning (e.g. Argote 1999). These assumptions help to link OL to the dimensions of time.

We organized this literature review along the three dimensions of time discussed in the previous section. The main findings of this review are summarized in Table 3, presenting core ideas and key mechanisms

Table 3. Overview of mechanisms identified in prior research on time and organizational learning

Dimension of time	Duration	Timing	Past, present, future
Core contribution	Time is an opportunity as well as a threat for organizational learning	Organizational learning benefits from a structuring over time that makes learning timely and synchronized	OL involves active and recurrent engagement with past, present and future

Key mechanisms	• Passage of time is an opportunity for:
	  acquiring experience
	  exploiting external developments
	  performing learning activities
	  observing delayed outcomes
	• Passage of time is a threat because:
	  knowledge becomes obsolete over time (antiquation)
	  learning content may be forgotten
		• Rhythms of OL activities:
		  event-time-driven learning routines
		  clock-time-based rhythms
		• Timeliness of learning:
		  temporal proximity of doing and thinking
		  windows of opportunity in the environment
		• Synchronization of OL activities
			• Multiple interpretations of past events may generate ambiguity and enrich OL
			• Reinterpretation of the past in light of new experiences
			• Imagination and anticipation of potential futures
			• Re-establishing connections between interpretations of past, present and future

for each of the three themes. We discuss the dimensions sequentially; later, we also discuss their integration and indicate opportunities for cross-fertilization.

Time as duration in organizational learning

Most OL studies that address time have focused on its dimension of duration. Time is incorporated as the elapse of time, measured by clocks or calendars, thus rendering time a measurable, unidirectional and homogeneous commodity. In these studies, the passage of time appears as an opportunity and sometimes as a threat for OL.

That time can be an opportunity for OL is most evident in learning-curve studies, in which the passing of calendar time has been found to predict performance (Argote 1999). A learning curve is a mathematical relationship between some metric of operational performance (e.g. cost, quality, speed) and a firm's experience in those operations (Zangwill and Kantor 1998). In manufacturing, learning curves typically refer to the pattern that production costs or production time decrease at a decreasing rate the more an organization produces. For example, Epple *et al.* (1991) used data from a North American truck plant producing a single vehicle and showed that direct labor hours required per truck decreased at a decreasing rate as the cumulative number of trucks produced increased. Such learning curves enabled the comparison of the speed of learning processes (Argote 1999; Sáenz-Royo and Salas-Fumás 2013).

Learning-curve studies and other studies of experiential learning show four mechanisms of time as an opportunity. A first mechanism is that time enables the acquisition of experience (Luo 1999). Debate has unfolded over whether elapsed time or cumulative amount of items produced is the driver of learning, as both elapsed time and cumulative amount of items produced may serve as proxies of experience (Adler 1990). Taken separately, both cumulative output (total number of items produced) and calendar time (weeks, months or years elapsed) predict performance improvement, although cumulative output is generally a more significant predictor of performance than the passage of time (Argote 1999). Disentangling these mechanisms, Argote (1999, p. 47) found that the shipyards she studied did not become more effective simply because of the passage of time, but rather because the passage of time allowed the acquisition of experience. Thus, the first effect of the passage of clock time is that it allows organizations to accumulate experience.

Other studies point at mechanisms of time as duration beyond experience acquisition. Based upon empirical data from the automotive industry about frequency of repairs for car models produced in subsequent years, Levin (2000) concludes that the number of years passed in a car model's production life best predicts a car model's ultimate repair rate – not cumulative production experience up to that point. Similarly, Martin and Salomon (2003) found that years elapsed had a learning effect beyond experience in a study of foreign investments in the semiconductor industry. Also, Argote (1999) reported earlier learning-curve studies from manufacturing industries in which elapsed time did have an effect even when controlled for cumulative output.

Such findings point at three other mechanisms by which time as duration offers opportunities for OL. A second mechanism, besides the acquisition of experience, is that technological improvements may emerge in the external environment with the passage of calendar time. New knowledge, technologies or materials may become available for incorporation in production processes irrespective of the amount of items produced (Argote 1999, p. 15).

A third mechanism is that duration offers opportunity for performing learning activities such as experimentation and reflection. Experience may not directly translate into learning, because activities and social interactions to learn from experience take time. In Levin's (2000) study, this included activities such as identifying root causes of problems, and proposing, designing, testing and implementing solutions to those root causes. Martin and Salomon (2003) also found a time effect beyond the sheer accumulation of experience, and explained that the passage of time allowed experimentation with novel technologies. This mechanism is also illustrated by the adverse effect of a lack of time. Engeström *et al*. (2007) observed how a lack of time for learning created a break in the learning trajectory of a health care organization, and multiple studies found time constraints as an important reason why organization members fail to learn through post-project reviews (Keegan and Turner 2001; Von Zedtwitz 2002). Intriguingly, Weber and Berthoin Antal (2001) reported the contradictory finding that lack of time intensified learning activities in a case study of a German governmental organization.

The fourth mechanism concerns the elapse of time as opportunity for OL when time lags exist between action and effect (Kim and Senge 1994). In his study in the automotive industry, Levin (2000, p. 632) found that producers did not get immediate feedback on reliability: it took much time before the first warning signs concerning reliability – from warranty claims and high-mileage vehicles like taxis and rental cars – came in. Thus, learning may require time until effects of actions are discernable and conclusions about action–outcome linkages can be drawn. If a long time lag exists between action and effect, organizations may be prone to superstitious learning if they allow insufficient time to pass before assessing the effects of prior actions (Levitt and March 1988; Rahmandad 2008). For example, Schwab (2007) studied baseball organizations that had adopted a new organizational practice (working with 'farm-teams'). Although this innovative prac-

tice could pay off no earlier than in four years' time, Schwab found that teams responded already the very next year to performance feedback, thus displaying superstitious learning about effects that could not be due to the new practice. Similarly, insufficient experience can generate inappropriate generalizations to future operations, thus displaying premature learning (Bapuji and Crossan 2004, p. 403).

These mechanisms of time as opportunity for learning create challenges for the speed of learning. Trying to compress learning means less time to acquire experience, incorporate external developments, perform learning activities, and wait for outcomes of actions to be observable. Rapid learning can especially be dangerous in a causally ambiguous situation, because early signals may evoke inappropriate conclusions (Herriott *et al*. 1985; Lounamaa and March 1987; Van de Ven and Polley 1992). In such situations, it may be better to wait for more experience to create a larger 'sample size' (Michael and Palandjian 2004). Therefore, Levitt and March (1988, p. 334) concluded that 'patience is a virtue' for OL.

Swart and Kinnie (2007) took the issue of slow learning and fast learning one step further by showing that organizations may need to combine fast learning and slow learning. They presented a case study of a marketing agency that learned simultaneously in multiple timeframes: a short-term 'accelerated time frame' and a long-term 'planned time frame'. Although short-term orientation has been linked to exploitative OL and long-term orientation to exploratory OL (March 1991), Swart and Kinnie (2007) offer a more complex picture. Their case study showed a short-term timeframe oriented at speed that was used for exploitation by delivering existing solutions, as well as for exploration through creative combination, and a long-term timeframe for exploitation by developing deeper expert solutions, as well as for exploration through renewal of capabilities.

Finally, it is increasingly recognized that time may not only be an opportunity, but also a threat. Knowledge acquired through experience may depreciate with the passage of time (Argote *et al*. 1990; Darr *et al*. 1995; Dimov *et al*. 2012; Epple *et al*. 1991; Ingram and Baum 1997; Luo and Peng 1999). Knowledge gained a long time ago may not help an organization to succeed in a current situation (Carroll and Hannan 2000). Depreciation may occur, first, because of 'antiquation', with knowledge no longer being relevant in a changed environment: for

example, because technological advances in the external environment render an organization's existing technological capabilities obsolete. In particular, exploitative learning has short-term benefits, but may be detrimental in the long run (Csaszar and Siggelkow 2010; Ingram and Baum 1997), because it is more prone to obsolescence than exploratory learning (Levinthal and March 1993). Yet, any judgment about obsolescence is relative to a specific context, because discarded technology may find new applications, and old ideas may be valuable in combination with new ideas (Nerkar 2003).

A second mechanism through which knowledge acquired through experience may depreciate is because of forgetting (Argote *et al.* 1990; de Holan and Phillips 2004). Argote *et al.* (1990) described the example of Steinway staff who wanted to take an old piano model into production again, but found out that they had lost the skills to do so. Learning from failure appears more resistant to forgetting than learning from success (Madsen and Desai 2010), and learning from rare disasters is less prone to depreciation than learning from minor accidents (Madsen 2009). Although forgetting is typically considered undesirable, it may also be beneficial and create openness for renewal (de Holan 2011; Easterby-Smith and Lyles 2011).

Duration as an agenda in future OL research. Studies of time as duration yielded some well-established conclusions: the passage of time is a condition for OL, because it enables the acquisition of experience, the incorporation of external knowledge, the execution of learning activities, and the recognition of action–outcome linkages; yet the passage of time also harms OL as a result of organizational forgetting and antiquation of knowledge.

From our analysis, we identify the speed of learning as a key topic in need of further research. This topic is particularly important in today's highly dynamic business environments. Learning speed is generally conceived as a worthwhile objective (Schein 1993) and is a common metric to compare learning curves (Zangwill and Kantor 1998). However, this typically refers to the speed of improvement due to OL; how this translates into speed of the process of learning is ambiguous. Some studies have pointed to the risks of fast learning (e.g. Herriott *et al.* 1985) and seem to call for 'slow learning': taking time and avoiding hasty conclusions. Such slow learning, though, might also result in a lack of sustained attention, indecision and forgetting. Future research could therefore investigate the pace of learning in terms of both speed and the time taken for learning, and thereby examine the mechanisms and conditions that render fast and slow learning beneficial or detrimental.

Further research is also necessary to explicate which mechanisms make recent experience more valuable than earlier experience and how that differs between types of experience (Argote and Miron-Spektor 2011; Thompson 2007). Such insights would also be valuable in better accounting for the role of forgetting in OL. Another issue calling for additional research is the duration of OL activities – including experimentation, gathering evidence, sharing interpretations and changing routines (Weber and Berthoin Antal 2001). Such insights would, for instance, enable a comparison of the benefits of spending more time on accumulating experience versus spending time on the translation of experience into knowledge and improving practice.

These areas for future research also call for additional methodologies. Much of the research reviewed so far is based on the learning curve tradition, which uses quantitative longitudinal data sets. This has provided strong evidence for the presence of learning over time, but offered little detail on actual learning activities as they unfold. In-depth qualitative studies are more appropriate to explore the mechanisms through which the passage of time and time taken for learning affect OL (e.g. see Swart and Kinnie 2007). For instance, to disentangle mechanisms of learning speed, we need to disentangle learning speed as measured in terms of performance improvement as learning-curve studies do and learning speed as in the time devoted to OL. Therefore, mixed method studies seem more appropriate to further advance insights on time as duration in OL.

Timing in organizational learning

The dimension of timing concerns the moments at which learning processes occur. Learning is embedded in unfolding flows of events, and its characteristics and impact will depend on what has come before and what follows after. Several studies of OL have explicitly or implicitly addressed timing and revealed rhythm, timeliness and synchronicity as mechanisms that affect OL, yet with less coherence than the literature that examined time as duration.

The timing of learning activities can be guided by event time-based and clock time-based temporal

structures. Exceptional, rare and unexpected events may provide an emergent opportunity for learning. Christianson *et al*. (2009) describe how the collapse of the roof of the Baltimore & Ohio Railroad Museum created an opportunity for the organization to rethink its identity and use the crisis to generate new energy and momentum. Such triggering events may also emerge in the organizational environment. For example, Engeström *et al*. (2007) describe how policy changes triggered responsive learning by two health care organizations. Organizations may also purposefully create events to trigger learning (e.g. Kim 1998), promote a crisis in learning (Antonacopoulou and Sheaffer 2013) or develop learning routines to be applied in the aftermath of events. An example of the latter are the after-action learning procedures as deployed by the US Army's Center for Army Lessons Learned (Thomas *et al*. 2001).

The timing of learning may also be based on clock time-based temporal structures. Several clock time-driven learning rhythms have been described in the literature: employees at Canada Post Corporation gathered each morning at 8:30 to discuss reasons for missed deliveries and remedial actions (Crossan and Berdrow 2003); at Kodak, the multifunctional team that developed the Funsaver camera made individual changes public in their shared work space each morning (Barrett 1998); Toyota employees conducted a systematic analysis each week to improve the way they did their jobs (Zangwill and Kantor 1998, p. 911); Staudenmayer *et al*. (2002) report the periodic use of 'buffer time' in software development; Berends and Lammers (2010) reported how bi-monthly steering group meetings facilitated the institutionalization of learning in a global bank; finally, De Geus (1988, p. 72) described Shell's emerging practice of using the first half of each year for strategic deliberation as an attempt to use planning as an opportunity for learning. Thus, organizations may purposefully create rhythms for learning (Rowe 2013), and these rhythms may unfold at time scales ranging from days to years.

The timing of learning activities has consequences for the timeliness of learning. The timeliness of learning depends on the temporal proximity of doing and thinking, two defining elements of OL (Edmondson 2002). Learning activities, such as organized reflection, may be more or less timely with respect to the events they address and the actions that they may inform. Such 'temporal proximity' enables learning that could get obscured or concealed as time passes: 'On the actual day of battle naked truths may be picked up for the asking; by the following morning they have already begun to get into their uniforms' (Cohen and Gooch, cited in Weick and Westley 1996, p. 449). Thomas *et al*. (2001) describe how learning procedures of the Center for Army Lessons Learned (CALL) enabled learning that was timely with respect to the action upon which it reflected as well as for the actions that it supported. CALL teams created thick descriptions of events as they occurred, and distributed lessons learned during operation in a five-day cycle. The timeliness of the insights thus generated, increased the value of the knowledge assets for those making decisions in the field (Thomas *et al*. 2001, p. 342).

The effect of temporal proximity, however, is not always straightforward. Temporal proximity differs for types of learning: improvisational learning is learning in 'real-time', while trial-and-error learning waits for effects to be accomplished (Miner *et al*. 2001). Some time may have to pass to translate experience into superior performance (Eggers 2012). Hayward (2002) found an inverted u-shaped relation between elapsed time and learning effect in a study of acquisition experiences (thereby establishing a connection to the dimension of duration). Moreover, the timeliness of learning is not necessarily a matter of purposeful timing. It is also about mindfulness of the impact of learning at a critical moment (Antonacopoulou 2009). Hence, there is scope to understand timing and timeliness beyond clock or event time-based routines. Instead, timing and timeliness place the experience of learning as the focus of the analysis and allows a greater appreciation of the dynamics in the learning practices of social actors (Antonacopoulou 2006).

The timeliness of learning may also depend upon the internal and external environment (Miner and Mezias 1996, p. 94). In particular, the environment may provide windows of opportunity for OL. Studies of the automotive industry showed increased learning before the introduction of new products (Dyck *et al*. 2005; Levin 2000). In his study of quality improvement, Levin (2000) found that learning occurs during ongoing production, but even more before the introduction of new car models. The period before a new model was taken into production proved to be a 'window of opportunity' during which the largest quality improvements were accomplished.

A final mechanism with regard to timing is the synchronization of learning activities. The timing of learning makes it more or less synchronized with

exogenous events and events at other levels (Rowe 2013). Lervik *et al*. (2010) demonstrated this in case studies of technical after-sales services, where the rhythms of situated learning in everyday work became entrained to external and internal temporal structures, including technology and product life cycles, the rhythms of customers and their production systems, and the rhythms of personal work–life and career trajectories. Adaptation to external temporal structures may be influenced by power relations (Fahy *et al*. 2013). Berends and Lammers (2010) found that a lack of synchronization between organizational levels hampered learning within a bank. Delays occurred where event-based learning by project members was force-fitted into the rhythm of bi-monthly steering group meetings. Yet, this does not mean that synchronization of learning with the environment is always beneficial: learning that is out of sync with competitors can be more profitable in a competitive business landscape than synchronized learning (Katila and Chen 2008).

Timing and timeliness as an agenda in future OL research.   Some studies made the timing of learning an explicit and core topic of investigation (e.g. Berends and Lammers 2010; Hayward 2002; Lervik *et al*. 2010), others touched upon it implicitly. As a consequence, research to date has indicated the importance of timing-related phenomena, including rhythms of learning, windows of opportunity for learning, the timeliness of learning and the synchronization of OL across levels. Yet, the evidence is still underdeveloped, and many specific research questions with regard to the timing dimension of OL remain unaddressed.

One topic for future research concerns the mechanisms through which clock-based rhythms affect OL. How do such rhythms emerge? What makes such rhythms effective? What aspects of OL allow structuring based upon clock time and which aspects are more likely to be triggered by events? Another potential line of inquiry concerns the synchronization of learning and the relation between the temporal structuring and the social structuring of OL. Berends and Lammers (2010) found that the temporal structuring depends on the social embeddedness of learning. There is a need to extend our analysis of how power dynamics influence moments and opportunities for learning.

Studies that have so far addressed timing aspects of OL have relied on qualitative research methods, often within single organizations (e.g. Berends and Lammers 2010; Lervik *et al*. 2010; Thomas *et al*. 2001), as well as quantitative methods (e.g. Eggers 2012; Hayward 2002). Theory development would benefit from qualitative comparative studies of multiple organizations, for instance to explain differences between rhythms of learning or similarities in synchronization of learning in a shared environment. Moreover, as Bingham and Davis (2012) demonstrate, combining qualitative and quantitative methods is particularly fruitful for developing and supporting theory on differences in the temporal structuring of OL over time. This also offers scope to develop new methodological approaches for capturing learning as it happens and to arrest the experience of learning through practising (see Antonacopoulou 2009).

Past, present and future in organizational learning

Whereas the dimension of timing concerned the place of learning events in a sequence of events, which can be analyzed from an outsider's perspective, the third dimension concerns how actors subjectively incorporate the past and the future in the present (Hernes and Irgens 2013; Mead 1932). Only a few studies of OL have explicitly addressed the temporal modalities of past, present and future, but they have clarified that this element of time is essential for understanding OL.

The significance of considering past, present and future for OL can be clarified by examining how prior experiences influence behavior. Studies that exhibit the perspective of time as duration, typically assume that learning unfolds sequentially over time. A key mechanism assumed in many studies is that OL occurs through preserving successful behavior and discarding ineffective actions (e.g. Schwab 2007). Thus, a pattern of behavior emerges after, and as a consequence of, experiencing the effects of prior actions. If OL only involved this mechanism, the initial experience might as well be forgotten: its effect is solidified in a pattern of behavior. In contrast, the subjective dimension of time enables actors to engage actively with their past. From a subjective perspective, organization members may access their past experiences repeatedly, by recollecting and reinterpreting past events (Garud *et al*. 2011; Kaplan and Orlikowski 2013). The past may be a living past and still be present. Of course, lessons learned may be solidified into routines, but that does not preclude that actors may also relive the past and draw new lessons from it.

In-depth studies of retrospective sensemaking for OL find that past experiences do not neatly translate into unequivocal routines. Multiple interpretations may coexist as a consequence of disagreements over the meaning of history (Levitt and March 1988, p. 324). Based upon a study of retrospective reviews of product design projects, Busby (1999) concludes that such project reviews can be helpful to combine insights of multiple persons, but that they also generated uncertainty and ambiguity as more knowledge was gained about events. This frustrated participants who expected that the collective review would reduce uncertainty about past events (Busby 1999, p. 126). Similarly, Oswick *et al.* (2000) offered a 'polyphonic perspective', according to which organization members construct, deconstruct and reconstruct meaning while reflecting on a critical organizational event. Oswick *et al.* (2000) actually challenged actors to generate multiple readings to enhance the potential for deeper and richer understandings, arguing that any attempt to construct a univocal account is inevitably intertwined with power. In a social learning situation such as OL, this is particularly relevant and important (Örtenblad 2002).

Moreover, interpretations of the past may change. Recurrent reflection on past events may change the meaning and implications ascribed to them (Hernes and Irgens 2013). For example, what was initially conceived as failure, may later be recast as a stepping stone towards success, resulting in different lessons for future behavior. Unusual past events, which do not fit established categories, may be reinterpreted in emerging narratives that organization members construct about their organizations (Garud *et al.* 2011). Organizational actors 're-view' their beliefs about prior situations in light of subsequent events and insights (Huy 2001, p. 607). Casey and Olivera (2011) argued that the reinterpretation of the past may be guided by interests and power dynamics: some interpretations of the past may be purposefully abandoned, whereas others may be highlighted. For example, corporate museums are used strategically to reconstruct the past to fit the way in which the organization wants to be perceived in the present (Nissley and Casey 2002).

Similarly, pre-viewing the future is an essential mechanism in OL. In most OL studies, the future is a rather empty concept, referring to later moments in which improved ways of working may be deployed. Yet, in 'inner time', the future is also present in the present, and may thus affect learning. Learning may start with the anticipation of rare events (Beck and Plowman 2009). Proponents of scenario planning have argued that the imagination and anticipation of future developments may spur learning, because that enables organizations to prepare for what is yet to come (De Geus 1988) and reinforce reflections on the present (Van der Steen and Van der Duin 2012). Van der Heijden (2004) argued that organizations should reflect on multiple future scenarios, because that enhances dialogue and counters groupthink, thereby mirroring Oswick *et al.*'s (2000) advocacy of allowing multiple accounts of the past. Moreover, envisioning potential futures directs attention to relevant signals from the environment (Splint and Van Wijck 2012), somewhat similar to the way scientific researchers form hypotheses and look out for data to test those hypotheses. Simulation results from Gavetti and Levinthal (2000) corroborate the importance of looking forward, finding that cognitive models with expectations about search outcomes made later experiential learning more effective.

A few recent papers have looked at connections among interpretations of the past, the present and the future (Garud *et al.* 2011). Kaplan and Orlikowski (2013) found that more radical innovations in organizations required intensive temporal work, referring to the redefining and reconnecting of an organization's past, present and future. Hernes and Irgens (2013) argued that continuity also requires such temporal work. Continuity is often taken for granted in OL, whereas it is better seen as an emergent accomplishment, requiring that managers engage simultaneously with an organization's past, present and future. They argue that learning under continuity requires establishing connections between the assessment of present courses of action; exploring future courses of action; and reinterpreting past courses of action. This process of reinterpretation is also central to 'practising', as it entails repetition at its core, which provides the space for both disentangling past and present, as well as connecting these to rehearse future actions (Antonacopoulou 2009).

Past, present and future as an agenda in future OL research.   An emerging set of studies has considered the 'inner time' dimension of past, present and future as relevant for OL. These studies showed its significance for the understanding of OL, but there clearly is a need for systematic study of the role of re-viewing the past and pre-viewing the future in OL.

Topics to be investigated include the practices that organizations use to engage actively with the past, present and future, the effects of those practices on

OL, and the role of plurality by engaging with multiple pasts (Oswick *et al*. 2000) and multiple futures (Van der Heijden 2004). Further, adopting this orientation as a lens offers scope for multiple connections among interpretations of past, present and future events to be considered. For example, how does the subjective experience of the present and the future affect how actors interpret the past? Similarly, how does the subjective experience of the past and present affect how actors imagine the future? Does a 'rich' anticipation or imagination of the future generate more opportunities for reflection later on, when anticipated or imagined events have become part of the past? Is practising a way of experiencing learning as a flow of past, present and future through repetition? These issues taken together call for a greater understanding of the attitudes actors maintain in relation to time and learning, which would be expected to have a bearing on their engagement with the past, present and future.

The dimension of past, present and future poses severe challenges for empirical research. Such inquiry cannot rely on retrospection, because retrospection is the very issue at stake. Instead, research should ideally follow actors longitudinally and investigate how their learning practices incorporate past, present and future. A promising approach for such longitudinal research would be, while tracing how learning emerges over time, to also continuously examine how organizational actors look forward and look back as they experience learning.

Connecting time dimensions in an integrated perspective

Taking stock of the extant literature on time and OL, the analysis presented offers a systematic account of the current state of the field. We note, however, that many studies have incorporated time without explicitly conceptualizing and theorizing it. Moreover, the issues addressed in reviewed publications typically concerned only a single dimension of time. In this section we move beyond this state of the literature by proposing an integrative framework (Figure 1). Building upon Adam's (2000, 2008) idea of timescapes, we argue that connecting dimensions opens up additional avenues for future research.

The fundamental idea behind our integrative framework is that OL is situated in timescapes. In any situation, each of the time dimensions can be implicated in OL. Our review of the existing litera-

ture indicated that OL processes involved duration and speed; timing, rhythm, timeliness and synchronicity; and the modalities of past, present and future. Being situated in timescapes means that OL processes are embedded in and influenced by each of these dimensions. Comprehensive understanding of the role of time and temporality requires attention for how all temporal mechanisms are involved in the unfolding of learning processes.

To advance insights into how OL is situated in timescapes, we can turn to social practices. Social practices are patterns of action that have meaning within a social context (Nicolini 2012), and much recent research has explored how OL is shaped by and embedded in such social practices (Antonacopoulou 2006; Berends *et al*. 2003; Brown and Duguid 1991). Simultaneously, Orlikowski and Yates (2002) developed a practice-based perspective on time in organizations and introduced the notion of temporal structuring to indicate how recurrent practices shape the timing of activities as well as their duration and temporal orientation. Practices are therefore a useful entry point to studying how OL is situated in multiple dimensions of time.

Ron *et al*.'s (2006) study of the practice of post-flight reviews in an F-16 fighter squadron exemplifies how practices shape the temporal structuring of OL. The practice of post-flight reviews guides timing, as these reviews are scheduled straight after action; they shape duration as they are typically planned for about an hour; and these practices are organized for systematic sensemaking of the past. Thus, such practices form temporal structures that shape how the dimensions of time are implicated in OL: they guide when learning occurs, how much time is taken for it, and how past, present and future are incorporated.

Our integrated model also points to some specific connections between dimensions, indicated by dotted arrows, without suggesting this to be exhaustive. Different dimensions of time are 'co-implicated' (Adam 1990): in any specific situation, we cannot have one without the other. For example, wherever organizations create a time and space for learning (Berthoin Antal 2006; Macpherson *et al*. 2010), they simultaneously shape the timing and duration of OL. In the remainder of this section, we discuss these emerging connections; numbers between brackets correspond to the numbering of dotted arrows in Figure 1.

Duration–timing. Previous findings point to intricate connections between duration and timing. One such connection (1) emerged where we discussed
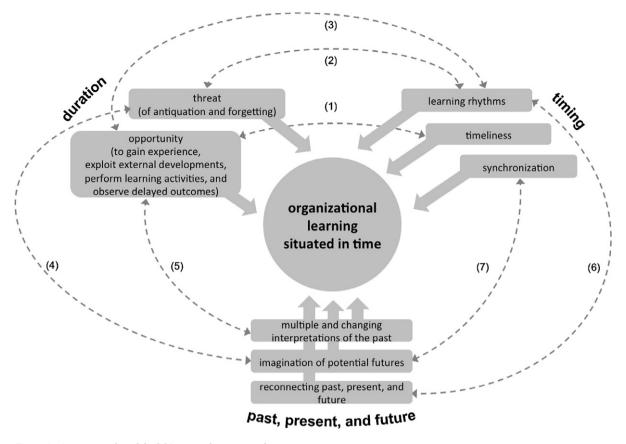
Figure 1. An integrated model of OL situated in time, with some emerging connections
Note: Gray blocks refer to mechanisms associated with the three dimensions of time.
Dotted lines with numbers refer to connections among mechanisms, explained in the text, indicated by the corresponding number.

temporal proximity: the effectiveness of the timing of learning depends on the length of time between the experience that is a source of learning and the activities in which those lessons can be applied (Hayward 2002). Similarly (2), studies may investigate conditions that affect the appropriate length of learning cycles. Cycles ranging from days to years have been identified, and the effectiveness of these cycles probably depends on the types and topics of OL. Further (3), Casey and Olivera (2011, p. 307) suggest that the cyclicality of organizational activities may affect the permanence of organizational memory: 'Recurrent activities, such as audits, training, and performance reviews, may compensate for the natural decay of organizational memory'. Thus, the rhythm of learning cycles might counter the depreciation of learning found in longitudinal studies on time as duration.

Duration–past, present, future. The engagement of actors with their past, present and future in 'inner

time' may also help to illuminate topics raised from a time as duration perspective. For example (4), several studies found that the value of experience decays over time (Argote and Miron-Spektor 2011). This is likely to depend upon how organization members engage with experience from the past. Perhaps this depreciation of experience holds in particular when experience is solidified into routines, whereas it may be counteracted by re-living and reinterpreting past experiences. That learning from failure depreciates slower (Madsen and Desai 2010) may be because actors engage in more elaborate retrospective sensemaking in cases of failure (Ellis and Davidi 2005). Moreover (5), continuing to reinterpret past experiences might counter premature and superstitious learning. The ongoing generation of multiple interpretations through retrospective sensemaking about past events may prevent organizational actors from premature conclusions or abrupt behavioral change. Similarly, recurrent attention to past events might aid unlearning and prevent individuals and

organizations from continuing with obsolete routines long after they cease to be justified.

Timing–past, present, future.   Finally, connections between the timing of OL and the modalities of past, present and future require attention. Analysis of the timing of OL can be reinforced by addressing how actors engage with the past and the future. One connection (6) to be explored is between rhythms of learning and the time horizons that are employed in organizations. Clock- and calendar-based rhythms of learning are likely to influence when and how far organization members look back to the past and into the future. Rhythmic learning can, therefore, help to connect and reconnect interpretations of past, present and future. Further (7), the mechanism of synchronization may extend from the timing of activities to the imagination and interpretation of the future. Collaborating organizations, for example, may need 'synchronized futures' to coordinate current activities and to create a common ground for interpreting signals from the environment. Working with different time horizons or expectations of the future could be a source of conflict. Synchronizing conceptions of the future might be achieved through shared practices such as collaborative scenario planning.

The framework presented in Figure 1 concerns OL as situated in time only, whereas other scholars have noted that OL is situated in physical space and artifacts in that space (Tyre and Von Hippel 1997) and situated in a social context (Antonacopoulou and Chiva 2007; Lave and Wenger 1991). Future research may explore how these different aspects of the situatedness of learning interact with each other.

Discussion and conclusion

This paper brings together the hitherto fragmented discussion of time aspects of OL, and advances an integrative perspective. Reviewing the OL literature with a temporal lens reveals the multiplicity of ways in which time and OL have been conceptually and empirically juxtaposed. We distil sets of mechanisms by which OL is influenced, but also note diffuse findings on the normative evaluation of those mechanisms. Effects of synchronicity, forgetting and speed, for example, may be beneficial as well as detrimental. Moreover, future research may explore the interaction of the three timescape dimensions that are emphasized in this paper, to generate more comprehensive understanding of OL.

In this paper, we sketched the outlines of an integrated perspective on OL as situated in timescapes, shaped by organizational practices. This multidimensional perspective on time has several implications for research on OL. First, a multidimensional investigation of OL may help to illuminate implications of changes in organizational environments that were alluded to in the introduction. One of these ongoing changes is the increasing pace of industrial and societal dynamics, as exemplified in shortening product life cycles. Building upon the analysis of time as duration, we infer that shorter time spans offer less time to acquire experience and to wait for effects to be observable. Yet, exploring the future to anticipate potential developments may help us to learn swiftly when events unfold, and recurrent reflections on the past may help to update premature conclusions. Finally, prospecting into the future and reflecting on the past to counteract the effects of speed can be enabled by a repetitive rhythm of learning. Thus, a systematic analysis of different dimensions of time and their interconnections one can help to understand challenges for OL, but also how organizational practices may shape temporal structures that address such challenges.

The perspective of OL as situated in multiple dimensions of time also has broader implications for research on OL. The timescapes perspective may help to bridge divisions between streams of research on OL that have developed in relative isolation. For example, limited cross-fertilization takes place between the quantitative research on experiential learning, rooted in the learning curve tradition, and practice-based studies of OL. Research in the learning curve tradition has used quantitative methods to study long time spans, employing the lens of duration. Studies into the social dynamics of learning and its embeddedness in practice have attended to temporality in day-to-day activities. Comprehensive understanding of the role of time requires that researchers attend to its different dimensions, thereby requiring the integration of research approaches and perspectives that too often remain separated.

An integrated, multidimensional perspective on time also has methodological implications for research on OL. Research should not only examine how processes evolve over time as sequences of events, as has been the focus of process studies into OL (Berends and Lammers 2010; Van de Ven and Polley 1992), or the effect of the passage of time, as has been the focus of learning-curve studies (e.g. Argote 1999), but also trace how actors

simultaneously make sense of the past, look into the future and create narratives that connect past, present and future in everyday practices. To study this multidimensionality effectively in longitudinal research, we need to take into account that research activities are situated in the same time dimensions. Any research takes a certain amount of time; measurements and observations are performed at certain moments in time, making them more or less timely; and researchers look back at the past, observe the present, or discuss the future. Effective research design requires that the timing of research actions is aligned with how particular OL processes are situated in time. Decisions regarding how long to undertake a study, when to enter the field, the rhythm of observations and interviews, at what time to ask respondents to reflect upon the past, and so on, can be more or less aligned with the temporal dynamics of the OL processes.

These time dimensions of OL research hold regardless of whether time is a central issue of attention. Hence, when studying, for example, the role of emotion, politics or diversity in OL, research design decisions could usefully take into account the temporal dynamics of OL. Knowing that interpretations of past events may evolve over time, for example, could encourage OL researchers to be more attentive to when such learning is studied. Further, knowing how much time it takes for learning to unfold invites researchers to be more attentive to the time span taken into account in a study.

Finally, the study of time in relation to OL provides a lens to investigate the processual and emergent nature of OL. Engagement with the temporal character of OL will provide scope also to understand learning as a process that entails an element of surprise and is thus emergent and not always defined by specific ends or priorities to which it is expected to respond. This latter point opens up the opportunity to appreciate the process of OL more fully in the way that time, timing, timeliness and timelessness define the experience of learning itself. Our hope is that, in drawing attention to these possibilities, we can inspire OL scholars to continue to add value through their research on one of these significant aspects of organizational life – learning in, with and through time.

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