

# Order, duration and rhythm: tuning to complex temporal arrangements in workplace learning

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## 1. Introduction

Few social theorists would deny that time is a central parameter of social life. Yet, researchers have often found it difficult “to develop a sustainable vocabulary for expressing process-oriented concepts” and even harder to find empirical data to sustain a processual view of the social world (Gilbert, 1997). Likewise, research in modern sociology has often failed to go beyond an objective and universalist view of time, associated with the clock and with chronology. It has generally limited itself to pay mere lip service to a complex and multilayered view of time (Adam, 1990; Clark, 2006). As a result, time often remains a taken-for-granted organizing device, merely considered as the more or less transparent stuff that “disappears into events, processes, movements and things as the mode of their becoming” (Grosz, 1999) rather than an object of inquiry to be investigated in its own right.

The recent developments of “time-oriented studies” constitute a notable and important departure from this state of affairs. Across a range of fields, researchers have taken as their explicit goal to flesh out the multiple and complex ways in which temporalities are organized, used, (re) produced or manipulated in daily social life. These studies view time as a central construct in our contemporary world, and seek to contribute to our understanding of its roles and nature. In management and organizational studies, this “problematizing view” of time is represented for example in the work of Adam (1990), Clark (2006), Morello (2006) or Cooren & Fairhurst (2004). In the field of sociolinguistics, to which we belong, inquiries into time and timing have received recent attention notably within the frameworks of mediated discourse analysis (de Saint-Georges, 2003a, 2004a, 2005b; de Saint-Georges & Fillettaz, forthcoming; Norris & Jones, 2005; R. Scollon, 2005a; S. Scollon, 2005), ethnographic microanalyses of social interaction (Erickson, 2004; Fillettaz, forthcoming; Goodwin, 2002) or other approaches to social semiotics (Lemke, 2005) attempting to modelize change and social transformations.

In line with the research developed by these authors, our aim in this paper has been to analyze data drawn from the construction industry to investigate how workers synchronize, desynchronize and make visible to others relevant temporal behaviors. Focusing on the actions of two individuals engaged in the sealing of an electrical box with a fast hardening cement, we have sought to explore the types of constraints the specific chemical properties of the material imposed on the pacing of workers activity. We view this empirical study as a showcase to illustrate two dimensions. On the one hand, we are interested in analyzing how individuals are “organizers of complex temporal arrangements and assessments” (Star, 1997) as a way to skirt the temporal constraints imposed by the material world. On the other hand, we also want to investigate the role played by the material world as an *organizer* of the

overall *dynamics* of workers' activities. In addressing these issues, it is more largely the question of the relationship between time, objects, knowledge and agency we would like to explore, through looking at how workers make use of *temporal competencies* (Filliettaz, forthcoming; Filliettaz & de Saint-Georges, 2006) in situated activities

## **2. Theoretical standpoint and methodological orientation**

The view of time we propose to discuss in this paper could be specified as being both *contextual* and *interactional* and our empirical focus described as being concerned with *discursive representations* of time and temporal processes. Below we briefly specify some of the theoretical background underpinning this view and the methodological consequences flowing from it.

### **2.1. A contextual and interactional view of time**

First, we adopt in this paper a *contextual view of time*. Work devoted to time has long found conceptions of time to be linked to cultural and social practices and contexts (Adam, 1990; Dunmire, 2000). It has also shown time to be an important resource for orientation in social environments (Strauss & Glaser, 1970; Zerubavel, 1981). In line with these premises, we consider that time issues are not universal but should be studied as they relate to specific environments and situations.

We also take a maybe less debated view by buying into the idea that time can be fruitfully analyzed as an *interactional* matter : something that social actors make visible and relevant in their actions with others for serving the purposes in which they are engaged. Participants in interactions may align towards various temporalities, deploy temporal skills to signal temporal frames to each other, adopt or contest the temporal frames proposed, turning time into a negotiated semiotic resource.

This contextual and interactional view of time, relayed for example in the work of Baynham (2006) or Goodwin (2002) has several methodological consequences. First, it requires an empirical focus on actual situations. This has led us to privilege in our analysis the study of real-time situated interactions documented through ethnographic observations. Secondly, language being an important way through which actors make time interactionally relevant, our perspective has also called us to devote a certain amount of attention to *discourse*. Adam (1990) points that as soon as we take up the issue of time we are bound to cross disciplinary borders. A few pointers can be given to how time and temporal issues have been dealt with in the field of discourse analysis as a way to contextualize our analysis (see also Filliettaz, forthcoming; Dunmire 2000).

### **2.2. A discursive approach to time**

In discourse analysis and sociolinguistics, the fields traditionally devoted to the study of discourse within the linguistic tradition, the study of time is rather recent, even though linguistics as a whole has had a long tradition of studying the linguistic denotation of time. The fields of semantics or cognitive pragmatics have for example classically been interested in the linguistic means speakers have at their disposal to mark relations of antecedence or subsequence between events or to index events to past, present or future points on a timeline (Bach, 1981; Reichenbach, 1947). We can think for example of verbal time (*I walk, I will walk, I walked*) or adverbials and dates (*yesterday, on the 4<sup>th</sup> of July, etc.*) as discursive resources for marking these relations. The writings of discourse analysts address some of these topics (Weinrich, 1973), but their interest has been mainly focused on other temporal dimensions.

The study of turn-taking in interaction, for example, has led discourse analysts to be interested in how conversations are sequentially organized and thus temporally ordered (Sacks, Schegloff, & Jefferson, 1978) and how sense making is a process of building meaning through analyzing what was just said in the interaction and anticipating what can come next.

Another interest has been the study of “genres” as socio-historical crystallization of ways of speaking or writing (time as history). A genre of text or talk is a constellation of features repeated over time and which also evolves over time. For example, Fairclough (1992) has shown how we are witnessing the colonizing of the “discourse of education” more and more by the “discourse of commodification”, creating hybridization of genres in terms of school marketing, productivity of research etc. The study of genre examines how they historically come about and how they subsequently transform through time or stabilize. Yet other researchers have been interested in the more microanalytical processes of synchronization of collective actions; using a certain prosody or tempo can entrain for example the joint accomplishment of collective actions (Auchlin, Filliettaz, Grobet, & Simon, 2004; Erickson, 2004b). On a more macro-level, the fields of narrative analysis and the more recent studies on “anticipatory discourses” (de Saint-Georges, 2003, 2004, 2005; de Saint-Georges & Filliettaz, forthcoming; Scollon & Scollon, 2000) have investigated how we use discourse to recall on past experience, to reconfigure them or to prefigure or prohibit future possible worlds and actions. A characteristic of the research mentioned above is that they have overall usually focused on isolated speech events (one narrative, one bit of conversation, etc.) and studied temporal processes within it.

In the last years, the focus has widened and discourse analysts have started to take on new directions in their study of discourse and time. They moved from the study of *time in discourse* to the study of *discourse in time*. One general direction is that more research has started to venture beyond the study of a single interaction to examine how threads of interactions are woven across time and space. In the domain of organizational discourse, (Cooren & Fairhurst, 2004; Cooren, Fox, Robichaud, & Talih, 2005; Gu, 2002; Iedema & Wodak, 1999) have shown how this mode of constitution across time and space was also a basic feature of *organizing*. Lemke (2005) has also proposed to study how human projects are sustained over more than microscopic units of actions and woven through certain stages of life or a lifetime of moving across contexts and situations.

Another direction taken has been concerned with the question of how discourses are related to actions. The issue here has been to study how certain discourses may participate in creating or prohibiting some actions and how some actions can in turn create new discourses or transform them. Work done in Mediated Discourse Analysis (de Saint-Georges, 2004; Norris & Jones, 2005; R. Scollon, 2005b; Scollon & Scollon, 2004) thus shows how actions and discourse acquire their meaning from the positions they occupy within historical sequences of events. It examines how people, objects, tools and discourses move at their own rates and on their own time-scales along trajectories. It examines the semiotic transformation undergone through this movement in time as a way to contribute to the understanding of agency, social action and social change.

As we see from this brief and selective review, a growing number of discourse analytical studies have thus recently endeavored to understand better the role and nature of time as a mode in which knowledge, social action and discourses ecologically develop, transform or exist.

In the next sections, we consider empirical material to study how workers from the industry use discourse to make visible and relevant various temporal properties of their work in interaction. Ohly (2002) points that while being attuned to organizational rhythms is usually a sign of successful integration in the workplace, these processes are not often explicitly specified. As a result we know little about how individuals deploy or learn to

master rhythms and timing as part of their professional knowledge, about the ways they learn to de-center from their own times and rhythms to adapt and integrate to others', or about the strategies deployed in the workplace to make temporal structuring visible to newcomers. More specifically, by looking at a moment of teaching the use of a particular material (a quick setting cement), our interest is in addressing the following issues:

- how does temporal knowledge circulates through an actual moment of work ?
- and
- how is timing and temporal structuring made visible to novice workers ?

We would thus like to focus on the temporal competencies deployed both by the expert worker and by the novice in the accomplishment of a specific task.

Before analyzing how temporal knowledge is made accessible in the empirical material gathered (section 4), we shall begin however by discussing briefly the setting from which the data is drawn and the rationale behind the selection of the sequence we discuss in our analysis (section 3).

### **3. The setting and the data : learning the temporalities of production work**

#### **3.1. Background context**

The data discussed in this research is drawn from a larger research project examining the role played by discourse and interactions in the process of learning new professional practices<sup>1</sup>. Part of the project is on the role of time in learning to become a professional in the context of vocational education. Among the topics studied are for example: what are the temporal constraints on learning within the school setting or the organizational settings in which apprenticeship occurs ? how does participation in professional practices evolve over time ? or how does one get attuned to professional rhythms and timing ? In the Swiss educational system, youth who do an apprenticeship move back and forth across places and activities: from the formal educational setting of school to learning in the workplace. In their trajectories of learning across these contrasted milieus and communities of practice, apprentices tune their tempo to different rhythms, learn to work and behave in a variety of manners, display different situated identities. Part of their learning (and of the challenge of learning) is to make meaning across these « chronotopes » (Lemke, 2004)—these different activities and places. The research program proposes that, in these conditions, learning is not just an individual endeavor but much more a collective and distributed activity. It also focuses on the role of verbal and non-verbal interactions to facilitate socialization into new work practices.

The data gathered includes moments of on-the-job learning at a work station and moments of training in more formal educational settings. For the purposes of this paper, we have chosen to focus on one of the more formal training situations. The rationale behind looking at a moment of training rather than an actual work situation for examining the construction of temporal knowledge in the data is that we assumed that a moment of explicit learning/teaching would allow us to see phenomena otherwise hidden in more expert courses of action. Cooren, Fox, Robichaud, & Talih (2005: p 277) refer to Pickering's argument that:

“ a retrospective look at processes and achievement always erases the uncertainties, the emergence, the dirty work of construction in which heterogeneous actors are mixed up through “mangle of practice”. Afterwards, the mess is cleaned up, as if not much

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<sup>1</sup> This research program is carried out under the auspices of FNRS grant number PP001-106603, attributed to Prof. Laurent Fillietaz, Head of the project

has happened. Real-time studies are the only window through which we can witness the process and achievements that make up the retrospectively unproblematic entities that fill our world" (Pickering, 1995).

Likewise, we posit that examining a moment of teaching/learning a professional practice is most fruitful to untangle relations between time, objects, and agency which may disappear in unproblematic moments of work.

The segment analyzed consists in excerpts from a videotape that was shot in 2006 in a company active in the domain of water, gas, electricity and thermic energy distribution to the city of Geneva where our team was involved in ethnographic observation. This company certifies apprentices in various fields (automotive mechanics, network administration, electrical assembling, among others). In total, the company trains 40 to 50 apprentices each year. Apprentices begin by spending 4 months in the company's internal training center, in which they learn various basic techniques in the industrial and building trade before being dispatched through various services in the company for on-the-job learning. The teaching received at the training center is modular and consists for example in 2 months of general mechanics, two weeks of masonry, 1 week of welding, etc. Training is delivered by actual employees from the company who are temporally discharged from their productive activity in order to instruct novices in their field of expertise.

The excerpts that will be discussed in a more detailed way come from a 10 minute sequence documenting an employee (here after MON for "monitor" in the transcripts) teaching the use of a particular material used in the building trade, a quick setting cement, to Pedro (hereafter PED), a future electrical assembler.

QuickTime™ et un  
décompresseur Codec YUV420  
sont requis pour visionner cette image

Figure 1: Teaching the use of quick setting cement

### 3.2. Description of the sequence analyzed

The sequence is constituted by four phases:

1. A phase of *preparation*. During this phase, PED is invited to round up the material that will be necessary to perform the action of cementing an electrical box in a wall. MON dictates to him which tools to take (a trowel, cement, a mixing pail, water) while PED is active gathering them around the warehouse.
2. A phase of *explanation*. During this phase, MON explains briefly what cementing consist of : deciding where the electrical box one needs to seal will be placed, mixing the prompt cement with water, coating with the cement the hole in which the box will be sealed, and finally, positioning the box in its final position. During this explanation time, PED is in a position of active listening: he attends to the explanations by nodding, asking questions, or offering solutions to practical problems. Much of the talking is however done by MON. Because MON and PED are neither gathering tool nor have started the cementing process, this phase

appears as a kind of “timing out” from the actual course of accomplishing the cementing.

3. The *action of cementing* itself. This phase is accomplished by PED under the supervision of MON who tells him moment-by-moment which action to take and literally guides him through its realization.
4. A phase of *evaluation* of the work of PED by MON.

The physical and chemical properties of the fast-drying cement impose very specific temporal constraints on workers’ activity and affect these four phases in different ways we will discuss in the analysis section. The quick setting properties of the cement present the affordance of allowing to seal *firmly and durably* objects (electrical boxes, tubes, etc.). The process of cementing presents also the characteristics that once started it is *irreversible* (it is not possible to “un-do” the action), it must be completed within a specific *duration* (about three minutes), and thus induce a certain *pace* to its realization. These constraints are part of the “ontological temporal structure” of the material used (Schutz & Luckmann, 1989). It must be learned in order to handle the material successfully.

Through studying the excerpts, we will thus examine the actions and discourses through which the temporal structuring of this material is made visible to the novice workers and then see some implications for the study of learning and for understanding the relation between knowledge, time and agency.

In the next sections we take on this questioning by focusing on how temporality is attended to and constructed discursively by MON, as well as experimented in situated action by PED. In our view, the strategies deployed by MON to give access to the particular temporal properties of the activity of cementing fall under three categories that we will illustrate with actual examples from the data (section 4). In section 5, we discuss how the illustrations presented contribute to a more general reflection on action, organization and learning.

## 4. Accessing knowledge about temporal processes

For the convenience of presentation, we propose to distinguish three general categories under which “temporal knowledge” is relayed in the data. They reflect the classical categories of *order*, *duration*, and *rhythm*.

### 4.1. Order

One way in which apprentices are made aware of the temporal structuring of work processes is through instruction regarding the relation of antecedence and subsequence between events in the process—the sequential organization of actions. Alerting to ordering and sequentiality takes various forms in the data. In chronological order of appearance in the segment analyzed, we can point to four of them:

#### - successive listing

During the phase of preparation of cementing, MON invites first PED to round up the material that will be needed for the cementing. This invitation comes in the form of an ordered succession of directives listing up various tools and substances to be gathered:

(1)  
MON : ok then you can take/... the smALL TROWel/  
36'47 PED : ((goes and fetch the trowel ))

36'53 MON : the small trowel/ **you take a small amount of:** ((points to the mixing pail) **quick setting cement/**((points to the bag of quick setting cement))

PED : what do I take/ one trowel/ ((moves towards the bag of quick setting cement))

MON : you no **you take you:r the the mixing pail** ((points towards a bucket)) that's what we call that's a mixing pail right/

37'04 PED : ((takes the mixing pail and moves again towards the cement- sack)) what/this/

37'09 MON : **then you try to take a bit of what's on the side** yes/ ((fills the pail with quick setting cement))) **you fill it up/...**

The ordering of the list is performed through the use of various temporal markers pointing forward in time (*then*) and through the directives, which organize next action in the moment-by-moment development of the sequence ("**you can take** the small trowel", "**you take** a small amount of: quick setting cement", etc ). In this sequence, PED is guided through a chronological process and learns turn after turn what objects will be required to perform the task.

Knowledge about temporal processes has consequences in terms of agency. While MON displays an ability to move strategically in defining the situation, to orient the activity of someone else and to impose a certain pace and organization to it—all signs of agency, PED because of his limited horizon of awareness can exert agency only in reactive rather than proactive mode. He is reduced to a moment-by-moment discovery of the items on the mental list of MON and is neither in a position to anticipate what will come next on the list nor to establish continuity between items on the list and the whole process of cementing. As a result, PED needs at several points to clarify the material needed ("what do I take/one trowel? What, this?"), signaling the uncertainty against which he navigates. Asymmetry in knowledge thus delimits the range of possibilities each of the participants has for projecting plans and concretizing them at any point in time. Part of the process of teaching/learning is to broaden up this horizon of expectations.

#### - access to anticipatory competencies

MON's discourse also raises awareness and gives access to *gaining anticipatory competencies* about the task, that is ability to foresee tasks which come later in a sequence. The following excerpts takes place during the *explanation* phase when MON explains what cementing consists of:

(2)

38'42 MON : ok, er, **so for the first step/** ((kneels by the wall)) it would already be\ ... okay so we will check if we can put everthing together in there or in general one already put the box in/ ((manipulates the electrical box and the pipe)) **but the problem is if we put THAT** ((points to the pail of quick setting cement))\ it is going to plug the hole\ ... **so we already put our pipe in/**

39'00 PED : should- shouldn't we cut the pipe a little bit first/. so that er it can get in/\ with the box/\ because there it is a little too long\

MON : in fact we could/\ it it would work\ or we could do something else/ I just want to show you a trick/ ((takes the box back and the pipe)) sometimes the thing is that you have to veer around/\ **so.. first step** ((places the box in the hole)) **it would be to place it where you need to place it okay/ you watch were it goes/\ after you put this/** ((presses the pipe)) **and you can always fix it/**

39'27

. the problem when when you do it like that is that you fill the hole\ . <yep> . so provisionnally we leave it in there to avoid plugging the hole/. <yes>.... you must already choose the place where it will go right/

PED : yeah yeah

In this sequence, MON explains that before accomplishing the cementing one must anticipate where he will place the electrical box and the pipe through which the electrical wires inserted in the box should go. MON thus mobilizes past experience to organize a future event. Experience teaches that one of the risks in performing the cementing is to not allow enough space in the hole to place the box.

The explanation is presented as abstract and theoretical, as signaled by the use of the conditional form with their associated connotation of "non-reality" ("so for the first step/ it would already be\ », « if we put THAI ((points to the pail of quick setting cement)). It is going to plug the hole\ . so we already put our pipe in/ », « first step. it would be to place it where you need to place it okay/ »). It is indeed a property of discourse that it presents the possibility of exploring scenarios which in practice could not be experienced, and to make salient certain dimensions of the process the meaning of which could not be reconstructed from simple observation in the flux of the activity. As a case in point, the *time-saver* described by MON as a "trick of the trade" could not be learned by PED in the current context because it concerns situations where "you have to veer around", a case not encountered here. The trick is to place the box provisionally as a place-holder and to determine its position before doing the actual cementing. The discussion thus points to the fact that two anticipatory competencies are in fact being built in the sequence: a *local* anticipatory competency to foresee next steps in the here-and-now of the activity, and a more *global* anticipatory competency to expect certain situations in a future professional life remote in time and space from the current moment. In this way, MON shows his commitment not just to facilitate PED's realization of the cementing in the here-and-now of the interaction but also to give him access to resources for the longer-term.

### - explicit sequencing of action

Still in the explanation phase, MON also undertakes to *explicitly* explain the different phases of the action of cementing. His discourse is thus prefigurative of the action to come and temporal markers (so, then, and then after, etc ) cue to a set of ordered step to be taken to accomplish the task:

(3)

39'52

MON : okay/ ((points to the bowl)) so we **first** put ((take away the mixing pail)) a dishful in the back/ . ((points towards the towel)) **when you will have mixed it up/then** you will push it inside/ ((takes the box and place it in the back)). **and then after** with the back of your trowel/. you will fill

PED : all around it\

MON : all around it with the BACK of the trowel you will fill it up\ <okay> but **the first step** is to stuff it in/ with the back **and then/** . prffff

40'13

PED : stuff it\

MON : you stuff it in/you'll see/. **and then** try to avoid to put cement here/. or if there is try to take it out with a pencil:/ ((takes a pencil)) or you do like this:// ((take the pipe)) you see// to avoid to put cement THERE/ ((points to the bottom of the box)) **and after that** we will place the pipe\



Because of the irreversible properties of the cementing process, it is critical to complete actions in a relatively strict sequence if one wants to perform successfully the cementing. Discourse however presents the possibility of tracking back and re-ordering sequences as a way of making salient certain dimensions of the process (e.g. “so first put a dishful in the back/when you will have mixed it up”). Often, the speed at which work processes are accomplished do not allow the reflexive and analytical time necessary to make sense of the details of the process or to understand “why” certain things are done the way they are. At stake with highlighting the sequencing of the activity in discourse is to learn a “logic of action” which has not been yet biographically integrated by the apprentice and to explicitly attend to making visible elements otherwise likely to “fly below the radar” (Erickson, 2004b) of his attention.

### - Typification

Through his discourse, MON also typifies behaviors or contrasts the patterns of activities accomplished within the frame of the training center with that which would be expected in the professional community. We place this process in the “typification” category because rather than referring to the local organization of order, typification refers to an ordering “true at all time”, a general practice. Examine the following excerpts in which MON points out that a general practice of masonry is to always clean the space on which one works:

(4)  
 40'27 PED : okay so then ho-  
 MON : (okay ; now) in general ((points towards the pail)) for cementing\ . one must always... SPRINKLE it with water ((points to the hole))  
 PED : wet the ((points to the hole))  
 MON : so that it sticks well\ free it from dust\  
 PED : sprinkle it with water / . ((touches the back of the hole with his hand)) ah yeah okay \  
 MON : anywhere sprinkled with water dusted it must be clean. So that it sticks\ <oh yeah yeah> here we do not REALLY need this becau:se we will rebuild we will dismantle the wall tomorrow/ <yeah> it will avoid us: er: a lot of trouble/<okay> so in general in masonry we: we sprinkle water we moisten always before\ . so there you can mix it/ ((points towards the pail))

Noteworthy in this excerpt is that against typical masonry practice which is to build structures that last, the structures constructed within the space of the training center are made to be ephemeral. The excerpts point that a training setting is structured by different ends than those prevalent in a productive setting. It focuses the attention on a step to be habitually taken in the process but that will be omitted in this particular instance of its realization.

## 4.2. Duration

A second general way in which attention is focused on temporal dimension of work processes is through referring to processes' *duration*, which is to say to the length of time they occupy from beginning to end. Clock time here is only one of the many ways used to point to the duration of the cementing process. Below we point to several guises under which temporal processes appear to be measured.

- clock time

At several points, MON makes references to the time the prompt cement takes to dry up in terms of minutes or seconds. In the sequence below, PED is just beginning the cementing process under the guidance of MON:

- (5)
- 40'58 MON : yes. you moisten it with water you must- but you must go fast right/  
PED : ah okay/ ((gets the water bucket closer to him))  
MON : there you have- you have  
PED : a few seconds ((mixes the pail content with his fingers))  
MON : you have no no you do have **THREE minutes** to mix it place it\ if you have big chunks ((points towards the mixing pail)) you take them out\ you have **three minutes** and. You will push your box inside\ (( does the gesture of pushing the box))

In the excerpt, PED perceives phenomenologically the cementing time as even shorter than it actually is ("a few seconds" versus "three minutes"), having internalized already how speed was a crucial dimension of the cementing process ("you must go fast"). While clock timing appears to be very precise, it does not require to be timed by a watch. It is the physical properties of the material which indicate when the process has started to become irreversible as shown in (6) :

- (6)
- MON : you immediately feel it when it is going to set <mhmm> so you still have the time to put [the cement] in now. <yeah> you still have the time to put it in\  
PED : ((put cement around the box))  
MON : the reaction it happens in 10 seconds you will see \ for the moment you still have the time to put it in/ in the right way\ coat it well\ and most important to place your box at the right place/ because as I was saying in 10 seconds its ::

The point of no-return is when the material solidifies. Until there, there is some lee-way for continuing to perform the process. MON introduces thus a distinction between the time available for the mixing and placing to be done (three minutes) and the actual chemical reaction (10 seconds or until you feel it). Below, we will also see incidentally that what is presented here as *absolute time* is in fact a much more *relative time* than it could seem at first glance.

- chemico-physical time

Referring to how long he should mix the cement with water or "prepare it", MON often uses references to what can be called a "chemico-physical time". For example:

- (7)
- 41'20 MON : yeah go on you can put X until it becomes doughy\

- (8)
- MON : okay go on you can go on mix it up it's a material you should not sleep right/  
okay very good yes keep going/. It's okay if you're not going to the bottom/. It will be perfect\ you must mix

well okay/ until the point when you stop having lumps in  
it/  
42'38 PED : ((mixes the mixture))

R. Scollon (2006) underlines that

“Many of the materials we use to take action begin in relatively inert or stable conditions. The work is to combine them to produce a changed material which then becomes relatively stable again over time. Sand, gravel, Portland cement, and water can be combined and mixed but once they are mixed they begin to harden into the material we call concrete. From wet mixture to dry and hard stability takes several hours. This sets a limit of a few hours for the shaping, leveling, scoring, and other actions that constitute laying a new sidewalk.”

He proposes that actions thus more than just being entrained to “biological pacemakers” (metabolism, breathing, heart beat, etc.) or “geosemiotic” ones (gravity, the movements of the moon around the earth) are also entrained to “material physical processes” associated with the substances and materials we use in action. In our example, likewise the chemico-physical properties of the quick setting cement set limits even tighter than concrete imposes on the laying of a sidewalk. In both cases the effect of the material is however the same: it restricts and create boundary conditions on the use that can be made of it.

### 4.3. Rhythm

One last resource used by MON to make PED participate in the temporal structure of the activity that we would like to discuss is through “rhythmic entrainment” (R. Scollon, 2005), which has to do with the speed at which processes are accomplished and the general feeling that an activity is hurried or slowly paced (Lemke, 2005).

a) There is first a general categorization of the activity of cementing as **an overall “fast paced” activity** as illustrated in by the metaphoric expression in (9) “you should not sleep” :

(9)  
42'20 MON : Okay come on you can :: go on mix it \ ... it's a material  
you should not sleep/

b) There is also rhythm as it is experienced in the dynamics and the structuring of the activity of cementing itself. Three different rhythmic entrainments are found in the data:

b.1] Before the apex of the action, there is an overall **subjective feeling of *having the time***. The tempo of the discourse is regularly paced:

10)  
45'17 MON : and you push it to the back\ . the material\ . yeah very  
good\ . . you see that you still have the-the time to  
manipulate the box there\  
45'26 PED : yes ((coats cement around the box))  
45'32 MON : that's it\ . . good\ . . especially when you start/ to feel  
that it sets/ . you place it straight/. The way you want it  
because there we see that it's all crooked/ . that the hole  
is not cleared/

b 2] As the cement starts to set, the pace of MON's discourse accelerates. Although we lack prosodic features in this transcription to show the accelerating pace of both action and discourse, the actual data shows a raises in pitch and volume of MON as he utters "so now you must quickly position it the way you want it", "you have a few seconds", "don't sleep") until the action is terminated. There is an overall **subjective feeling of being hurried** through the action:

(11)  
 45'46 MON : here it begins to set / right/  
 PED : ((adjust the box))  
 45'49 MON : so now you must **QUICKLY** position it the way you want it/  
**you have a few seconds** okay/there/ and then clean up under  
 it\  
 PED : ((remove the cement at the bottom of the box))  
 45'56 MON : your hole. without trouch- without touching the box too  
 much/ get rid of what's under/ completely get rid of/ So  
 that you have the room for your tube\  
 PED : yeah((removes the cement from the bottom of the box  
 MON : and watch to see if it's stand straights/. **don't sleep**/  
 PED : ((look at the box and adjust its position))  
 MON : watch to see if it's stands straights facing it/ if it's a  
 little ((adjust the box)) okay/  
 PED : ((wipe the cement from the bottom of the box))  
 MON : there it is at true level:/ it's straight/.. okay/ that's  
 good there \

In the excerpt, the rhythm of the work process is not only explained, it is also experienced first hand by the apprentice. As the rate of MON's speech accelerates so does the speed at which PED performs the work. When the prosodic rhythm of MON falls back into a low pitch, the pace of the action returns to a slower rate and MON utters the evaluative utterance "It's good there".

b.3] Finally, after the box is cemented, **the rhythm of action slows down** even further to come to a **point of halting**:

46'54 PED : ((comes close to the wall and kneels down))  
 MON : ((kneels down and get hold of the box))... you see  
 there you have **already now it's too late**\ you see/  
 ((tries to move the box)) <mhmm> now it does not move  
 anymore\  
 PED : ((gets hold of the box and tries to move it))  
 MON : **it's what I tell you you you have 30 seconds**\  
 PED : pfff  
 MON : no stop/  
 PED : ((let go of the box)) yeah  
 MON : if you move it now/ everything will break down\  
 PED : ah okay/  
 MON : **it's too late**\  
 PED : I am going to empty this ((gets up and walks towards  
 the dumpster))  
 47'08 MON : now the cementing is done/ ((gets up))

After the apex, time has run out (« it's too late »). No action can be taken anymore and the process of cementing can be deemed terminated even though the physico-chemical process of drying has not totally gone round its cycle.

Oliy (2002) argues that operators manipulating machines or substances with particular temporal properties are always aware of temporal criteria while working (duration, cadence, timing, etc ). They tend to be at all times in an attitude of anticipation to avoid situations in

which they could only be reactive. To a large extent, MON's timing of the activity seems to be a tactical use of the knowledge he has about the use of prompt cement. To ensure the successful and timely completion of the activity of cementing, he pushes PED to adopt a rhythm slightly faster than would be required by the properties of the cement. MON's is thus a "race against time", to free some sort of "cushion time" allowing to not be caught in a situation where the cementing activity would not be finished but the process of hardening/drying would be. Time in the data is thus not only *represented, used*, but also *manipulated* by MON to achieve his teaching/learning ends.

## 5. Concluding discussion

What are some of the implications that can be drawn from the illustrations above?

First, through our analysis of the ways in which knowledge about temporal processes circulates through a moment of learning about a work practice, we have sought to underline that temporal knowledge is complex and multiple. Learning even a relatively simple action is always learning to synchronize or de-synchronize from one's own rhythm and time to adapt and adopt the timing proposed or imposed by other individuals or objects. In the sequences observed, learning how to use a certain material is also developing competencies related to duration, pace, order, prospective, acceleration, etc. Further empirical study of this kind should provide us with a "a rich repertoire of conceptual tools for analyzing (the different levels) at which time plays a role in action and in meaning" (Lemke, 2005). In our view, such empirical studies are very important in order to avoid reducing the fundamental complexity of action and the flattening of the multiple layers of time involved in any one action (R. Scollon, 2005).

A second implication that can be drawn from the illustrations is that the study of the "ontological temporal structure" of the objects used in action should not be neglected when examining social actions. Actors act at the intersection of multiple timescales and objects impose certain constraints on action. While some of these constraints are "objective" and constitute resistances against which we must necessarily navigate to act, the study of the temporal structure of objects should also make us aware of the moments when some temporal features presented as "objective" are in fact forms of time manipulation, or to think about how some objects can "buy us time" or restrict it.

From the point of view of vocational learning, an empirical analysis of the kind proposed illustrates also other phenomena. First, it shows that temporally-oriented descriptions of activity have important pedagogical functions. By emphasizing and distinguishing action units in his discourse, MON contributes to clarify, distinguish, categorize elements which have meaning for him and thus in the professional arena. Using temporal connectors allows him to order operations which might otherwise appear to the novice as an uninterrupted flow of gesticulations. Discourse moreover allows process of integration, elaboration and organization of meaning on a cognitive level. It is not only that events are sequentially organized in discourse. Discourse also allows to make available to the novice the meanings MON construct around these sequences of events, their relative significance or insignificance in relation to each other, or the indices on the basis of which his decisions are made. Because of the speed imposed on the work process by the material substance used, these meanings could not be understood by simple observation and imitation for PED. It is thus in the dynamics between actions and discourse that the learning of temporally complex work processes seem to be possible.

Another finding underlined in the empirical analysis is that professionals reason and act on temporal timescales which go beyond the bounds of the here-and-now of the situation in which they find themselves. For example, as a professional practitioner on temporary leave

from his operational position in order to teach, MON brings to the pedagogical process knowledge and practices originating prior to the moment of instruction and experienced a great number of times in productive work. Prior knowledge thus becomes a resource strategically used for organizing his “teaching” activity. This knowledge allows him to identify privileged moments for instruction. For example, the explanation regarding the cementing process is not given directly and only “on-line” (during the accomplishment of the action), but first deployed upstream from it, during a phase of “reflective” time, outside of the temporal pressure which the cement would otherwise exert on the activity. Likewise, this knowledge of the temporal properties of the cement allows him to hierarchy and give temporal precedence to certain actions over others and to manage the pace of the cementing so as to ensure the placement of the electrical box before it becomes too late. This leads us to the conviction that the excerpt analyzed points to a fundamental *hybridity* of training and teaching activities in this workplace. On the one hand, training time is a kind of “timing out” from productive activity. Time constraints associated with production are suspended in favor of time closer to “pedagogical time”: a time relatively elastic because there is large room for explanation, interruption, backtracking in case of error, a time which runs at a more leisurely pace than would be expected in more productive situations, a time for building ephemeral and perfectible objects. On the other hand, this training time is not disconnected from production time. In presenting the cementing process, MON adopts for a relatively linear presentation, close to how he usually performs the work as a professional. If he had reasoned in term of a pedagogical progression, this might have brought him to completely re-organize the sequencing of activity for the purpose of facilitating PED’s cognitive development. From this discussion, it thus appears that a next step to take would be to construct better knowledge about how the “artful and adequate use of time” is transmitted in other types of settings. This research would treat the teaching of temporal knowledge as a practical problem in its own right, and examine the type of solution given in different settings to teach and make available temporal resources to newcomers.

From the perspective of organization and workplace learning, finally, the illustrations developed in this paper raise some interrogations on at least two planes. First, it raises issues concerning the kinds of space/time available for learning: what are the pressure that productive work exert on training and learning? what are the best conditions for learning: being caught in the flux of event and learning by entrainment, timing out for reflection and analytical action, or a combination of both? More largely, examining what are temporally favorable moments for instruction and exploiting them through giving them rich content, giving workers the possibility to be in a position of longer-term anticipation as a form of accrued agency, ensuring that the tempos to which they are entrained are not just effects of manipulation but have justifiable ontological reasons for being paced to a certain rhythm are all matters which need more explicit thinking. Indeed, events in the workplace happen in a sequence in time, but it is in their significance to the social actors that they deserve to be understood.

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