

Situated trajectories of learning in vocational training interactions

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This paper investigates smaller-scale transitions that are part of the longer-term processes of subjective transformation and adaptation to new professional competencies for learners in the field of vocational education. On the conceptual level, it proposes to view transitions as intermediate states in situated trajectories of learning. The notion of trajectory aims to capture that (a) learning occurs through situated and highly contextualized micro activities and (b) that these activities occur within historical sequences of events, which come to form over time dynamic trajectories. The ingredients constitutive of a trajectory of learning are first defined. The notions presented are next applied to the empirical analysis of one sequence of learning, in which we show the transitions undergone by one object of knowledge as it is being taught to different apprentices in a workshop. On the theoretical plane, the paper thus proposes to view transitions as microdynamics of change. On the methodological plane, it contributes to identifying possible empirical sources and methodological frames to study micro-transitional phenomena.

Introduction

In the sociological and psychological literature, the notion of “transition” has been largely explored in relation to the multifold changes undergone by individuals in relation to their life span and life course: transition between school and work, between childhood and adulthood, between roles, etc. Transitions have been viewed to include two movements. On the one hand, transitions usually mark a form of break from a previous state of affairs. On the other hand, the individual undergoing transitions need to adjust to the new conditions (Zittoun & Perret-Clermont, 2002). Transitions are thus about dynamics of change and metamorphosis, and linked to processes of (new) socialization and learning. One of the question this literature has addressed is: given their biographical trajectories and the structural opportunities afforded by the new situations they encounter, how do individuals cope with the changes? And with what consequences for their psychological dispositions?

This article approaches the notion of “transition” from a somewhat different vantage point. Firstly, because it differs from other research in terms of scale. Drawing on data from the field of initial vocational education, it seeks to examine some of the smaller-scale transitions that are part of the longer-term processes of subjective transformation and adaptation to new professional competencies. Its focus is thus on transitions on the “event-scale” rather than on the life-course scale. Secondly, it differs from the body of research above in that if it focuses on processes of subjective transitions from some state of competency to another, it also examines the transformation undergone by knowledge when it transits from one individual to another. In our view, transitions affect not just individuals but also the cognitive and material environment in which they navigate.

More specifically, our interest in this paper is both a theoretical and a methodological one. On the one hand, we would like to propose that some aspects of transitions can be studied by examining what we would like to call *situated trajectories of learning* experienced by learners. The notion aims to capture that learning occurs through situated and highly contextualized micro activities. These activities also occur within historical sequences of events, which come to form over time dynamic trajectories. In our view, the study of these trajectories constitutes an empirically productive way to study transitional micro-phenomena. On the methodological plane, we would also like to identify possible empirical sources for the study of transition processes and discuss possible methodological frames to think about transitions and transitional processes.

With these goals in mind, our approach is three-fold. We begin by specifying our theoretical orientations regarding processes of learning (section 2). In section 3, we discuss our notion of *situated trajectory* and its potential usefulness for studying transitional micro-phenomena in vocational training. Finally, we illustrate our argument by analyzing empirical data collected in a vocational school. The data is about future automobile mechanics involved in ordinary practices of learning.

Theoretical and methodological orientations

Three theoretical points inform our account of learning and teaching in initial vocational education. Firstly, we view learning and teaching as *situated*, that is as phenomena to be approached in the real-time conditions of their accomplishment. Secondly, we also consider learning and teaching to be *collective* processes, that is processes involving the participation of various “others” in their accomplishment. Thirdly, learning and teaching are for us *multimodal* activities. They involve explanations but also demonstrations, the use of material objects, visual props or the performance of various kinds of actions organized to make meanings. These three dimensions have their roots in various theoretical frameworks and have specific consequences regarding how we carry research. In order to frame the discussion that will follow, we thus would like to briefly specify what we mean by these terms.

Learning as situated action

Our approach can be categorized as a *praxeological approach* to learning and training. That is, we consider that learning is best studied as something that happens in and through situated actions. It is tied to material and social circumstances. It also emerges from the moment-by-moment interactions between actors and their environment of action. We also view these material and social circumstances to be culturally and historically constituted. This view means that learning is both highly dependent on the circumstances in which it occurs, but also mediated by forces which go beyond the here-and-now. These ideas have been discussed by many authors (Béguin & Clot, 2004). They are borrowed in our case more specifically from the fields of *situated cognition* and *cognitive anthropology* (Heath & Luft 2000; Hutchins, 1995; Suchman, 1987; Theureau, 1992).

A methodological implication derives from viewing actions to be indexed to real-time activity and mediated by social, historical and cultural dimensions: cognition cannot be studied anymore through experimental designs within laboratories but is best examined as it unfolds in the real-time conditions of actual activities. In our research, we consequently privilege ethnographic observations and audio-video recordings as a means to construct our data over questionnaires and interviews. In examining learners in different professions (automobile mechanics, electrical assemblers and automation specialists) at work on different sites (school, industry), we have gathered more than 120 hours of video recordings. The data allows analyzing situated processes but also comparing data across contrasted sites, detailing what makes each site unique, and analyzing how situational and organizational factors fit into the process of teaching and learning.

Learning as a collective process

Besides viewing learning as situated, we also view learning as an intrinsically *collective* and collaborative process. While knowledge construction and skill development always reside in the individual, the conditions and resources for learning are themselves social and collective ones. Learning occurs within social environments, which are the results of a history and shaped by a culture. *Vygotskian historico-cultural psychology* proposes for example that consciousness and “higher” cognitive abilities result from the interactions between the individual and culturally and historically mediating tools of his/her environment (Engeström, 2004). Learning and development are dynamic processes constructed in relations with pre-existing social, historical, and cultural realities. Individual learning is also a collective process in that it occurs in interactions with others. Lave and Wenger (1991, p. 98) for example put forward that learning is not a solipsist problem-resolution activity but results from ratified participation in *communities of practice*:

A community of practice is a set of relations among persons, activity, and world, over time and in relation with other tangential and overlapping communities of practices. A community of practice is an intrinsic condition for the existence of knowledge, not least because it provides the interpretive support necessary for making sense of its heritage. Thus, participation in the cultural practice in which any knowledge exists is an epistemological principle of learning. The social structure of this practice, its power relations, and its conditions for legitimacy define possibilities for learning.

Novices differ from experts in that they move progressively towards fuller participation in the community. Learning and the construction of identities go hand in hand. This idea is also found in the research done in the francophone field of *professional didactics* or the work done on *workplace learning* (Billett, 2001). It underlines the central role played by “others” in processes of training and learning and insists on studying what collective resources are available to workers in their workplace for learning and development (Mayen, 1999, 2002). Given this general orientation, we thus view learning as a social process that cannot be captured through studying psychological categories alone.

This orientation has again methodological consequences. Since we conceive learning processes as cultural, collective and negotiated, we focus our analysis on studying the interactions in which apprentices engage. That is, we examine interactions between (a) apprentices and teachers in professional schools, and (b) apprentices and trainers or colleagues in the workplace.

Learning as a multimodal process

Thirdly, following the social semiotic framework of Kress, Jewitt, Ogborn, and Tsatsarelis (2001), we take learning and teaching to be *multimodal* processes. In learning and teaching, a variety of semiotic systems or *modes* come into play: language, visuals, diagrams,

actions, architectural arrangement, objects, the organization of time and space, etc. For learning to occur, learners must have both access to a broad range of these modes of meaning-making as well as be able to use these resources to produce their own useful meanings. The teaching/learning process is consequently neither a direct transmission from the teacher to the learner. Nor is it a discovery that the learner makes on his/her own. It is rather a process of sign construction, sign transformation and co-construction of meanings between the two parties. It involves “a dynamic process of sign-making and transformation which actively involves both teacher and students” (Kress et al., 2001, p. 10).

Again, from a methodological standpoint, to analyze the audio-video recordings discussed in the article, we have used tools borrowed from recent developments in discourse analytical theories which have included this multimodal slant. From *Multimodal Discourse Analysis* (Norris, 2004; Scollon & Scollon, 2003), we borrow our focus on looking at how teachers/learners combine modes to accomplish specific actions in the world. *Conversation analytical tools* (Sacks, 1992) allow us to consider how face-to-face interactions are practical accomplishments, with participants mutually interpreting each other’s contributions in the on-going development of the interaction. Specifically, work by Goodwin (2000, 2002) inform our understanding that this accomplishment results from attention to a variety of material resources (linguistic markers, prosody, gestures, body posture, etc.). Our work is also anchored in *interactional sociolinguistics* (Gumperz, 1982; Schiffrin, 1996; Tannen, 1989) which studies how linguistic mechanisms (prosody, lexical choices, etc.) function as “contextualization cues” and frame the activities in which people engage (Goffman, 1974). That is, they are resources for participants in interaction to orient themselves in social contexts.

This orientation means we work from transcripts of interactions (Ochs, 1979), which are not limited to displaying the verbal dimension of human exchanges alone, but also make visible the relationship between discourse and other modes of making meaning.

Transitions as situated trajectories of learning

After this brief framing of the general theoretical and methodological orientations underpinning our research questions, we would like to turn in this section to specifying how we construct the notion of “transitions”, as a part of our conceptualization of “situated trajectories” (§3.1.), and “situated trajectories of learning” (§3.2). We next show how our argument applies to the analysis of empirical material (§4).

For us, the notion of transition is linked to topics widely debated in the social scientific literature, the ones related to “change” and to the modeling of “dynamic processes”. This modeling raises several challenges. One of them is to account for the linkages which exist between local micro events and their sequential organization, and more extended activity scales. Lemke (2000) stresses for example that we still largely lack an understanding of 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 situation. Following Cole’s (1996) proposal, he suggests that in order to understand complex situations and their evolutions, transitions should be studied at all of the following levels: “[...] from the microscopic (event scale), meso-genetic (extended activity or project scale), and ontogenetic (developmental-biographical scale) to the historical and evolutionary scales”. This research and others challenge the divide between local activities and more global ecologies through attempting to show how social organization is constituted across time and space. They also reflect upon the contribution of local interactions to the constitution of larger institutional orders (Cooren & Fairhurst, 2004; Cooren, Fox, Robichaud, & Talih, 2005; Erickson, 2004a,b; Mondada, 2006).

Other researchers challenge the maintenance of the status quo and are concerned with discovering the conditions under which configurations of social practices deemed problematic for certain groups become stabilized or destabilized over the short- or the longer-term. Theoretically, *nexus analysis* (R. Scollon, 2006; Scollon & Scollon, 2000, 2004; S. Scollon,

2003), for example, takes it that actions and discourses acquire their meanings from the positions they occupy within *historical sequences of events*. It underlines that people, objects, tools and discourses have a *history* and project a *future*. They move each at their own rates and on their own *timescales* along *trajectories* (Scollon, 2005). These trajectories include points of change and bifurcations. In relation with transitions, the issue that a nexus analysis project tackles is how can we model – or even produce – tipping points in social processes.

Yet others, notably in the field of education, are concerned with the fact that learning is a process of knowledge appropriation and transformation over time, a form of *chronogenesis* (Chevallard, 1991) that can be best studied by synoptically studying courses of teaching and learning spanning several lessons periods (Schneuwly & Doltz, forthcoming).

The interest of these approaches in individual development and social change lead them to invent process-oriented concepts and methodological tools to account for changes at different scales. They insist that modeling change requires going beyond the level of the single event to understand how several events can be related and re-interpreted or re-semiotized over time.

Since our interest in this paper is not so much on large-scale changes but on tracing trajectories of knowledge, people and discourses at the event-scale, in the remainder of this article we would like to make a case that for this purpose the notion of *situated trajectory* can be useful to study mechanisms of transition empirically.

The notion of situated trajectory

The notion of trajectory is maybe most famously linked in sociology with the work of Anselm Strauss (e.g., Strauss, 1992; Strauss & Barney, 1970), who in the mid-60s conducted studies on the way the process of dying was dealt with in the organization of hospitals. The studies showed that the pacing and development in time of the agonizing process had consequences on the care of dying. Its unpredictable length and the limitation of resources to take care of the dying for both staff and relatives of the dying person led Strauss to conceive a “*trajectory model*”. It became one of Strauss’s key theoretical contributions to sociology (Baszanger, 1998; Star, 1997). In Strauss’s conceptualization, a trajectory of illness is constituted by a series of successive, overlapping tasks. These tasks taken together come to form “*arcs of work*”, that is:

[...] a kind of map-making through which the chief physician – conceived as the main *trajectory manager* – visualizes the actions to be taken and the necessary coordination of these actions which will bring into play very different specialists, working in very different geographical sites (units in a given hospital, other hospitals, or other places entirely) (Baszanger, 1998, p. 11-12, underlying is ours).

The trajectory’s shape is highly dependent upon the emergent actions of the practitioners. It is largely unpredictable because it results from the always unforeseeable evolution of the illness, but also because of the biographical trajectories of the actors involved in the care of the patient, the history of medical tools, medical specialists, or the hospital as an organization, etc. All of them influence the course of the trajectory.

The interaction of efforts to control the illness and the contingencies (predictable or not) shapes each trajectory. This attempt to control and shape the trajectory is conceptualized as a *trajectory projection*. Significantly, the different actors involved in the illness do not necessarily share the same projection: the more problematic the trajectory, the more lively and numerous the differences in projection and the more likely *trajectory debates* will occur. The choices are often difficult to reconcile. This is true at each *point of option* since these schemas of the trajectory are not fixed. The schemas of the physician and the patient change in response to the illness, treatment, other pertinent social conditions, and across the different *trajectory phases* (Baszanger, 1998, p. 12).

These ideas lead to a view of structures “as processes” and “in process” (de Saint-Georges, 2004, 2005), that is including a series of *transitional statuses* and passages (Baszanger, 1998) to handle the ever emergent changes presenting themselves.

Building on Strauss’s work, we would like to propose a tentative *definition of a “situated trajectory”*. We conceive the notion first as a tool to trace the evolution of some ingredients in a situation (a material object, the identity transformation undergone by a participant, the resemiotisation of some discourse, the evolution of an object of knowledge, etc.) on the time-scale relevant to the process examined. A situated trajectory consists in a series of episodes, empirically analyzable on the basis of detailed empirical traces constructed around them (e.g. audio-video recordings). The episodes constitutive of the trajectory are in a relation of mutual co-configuration. Each episode entertains relationships with past episodes and projects future pathways. The configuration of the episodes and the weaving of the transitions between episodes are accomplished through a variety of semiotic resources, which can themselves evolve and transform over time.

There is an apparent paradox in talking about *situated trajectories*. As soon as we talk about a *situated trajectory* we are indeed embracing two propositions that might seem to be at odd with each other. On the one hand, talking about a “situated” perspective means that we focus on actions as they occur in real-time, through the accomplishment of actual actors. On the other hand, the idea of a trajectory also implies that we are interested in going beyond the immediate horizon of situated actions to take into account longer time frames. Our view is in fact that neither of these propositions should be favored over the other or reduced to the other. Rather, we should affirm simultaneously that both these levels of analysis are part of one and the same process.

We could represent the notion of a situated trajectory in the form of a diagram:

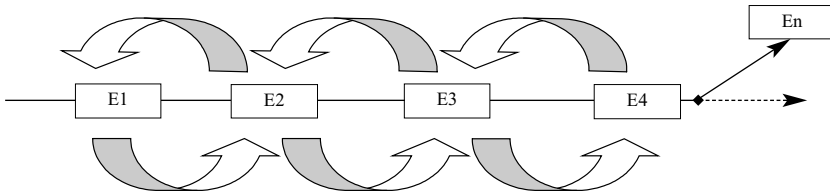


Figure 1. Transitions and (re) configuration of episodes in a situated trajectory (E=episode)

A discussion of the components of this diagram will serve to highlight the theoretical “ingredients” which come together in our conceptualization of “situated trajectories”.

- a) *Trajectories are temporal processes*: For a trajectory to exist, there must be some time that has elapsed. That is, time is an inherent dimension of trajectories. Trajectories come into existence by consuming time and time disappears into them. Trajectories are moreover not fixed in their structure but evolve as part of social and interactional dynamics. What we think of as “organization”, “order” or “structure” is thus in a way always only an instantaneous snapshot of a social order that can only be captured in a diachronic unfolding (Lefebvre, 2004). When looking at a trajectory, it is important to distinguish between *the course of activity* considered (its emergent evolution) and the *trajectory* of its management (the organizational work done to handle the course of activity), as Strauss suggests. One must examine the way its course is projected into an “arc of work” by a “trajectory manager” as well as its unplanned and unexpected developments departing from the projected arcs of work and how they are handled.
- b) *Trajectories are composed of episodes*: For us, the notion of trajectory is neither a generic concept, nor an organizational unit. It is rather a heuristic notion. A trajectory is composed of linked portions of activity that the researcher finds relevant for the research process. Depending on her/his goal, s/he will take into account longer or shorter chains of actions. A trajectory can thus be of varying length and combine any number of episodes.

The episodes are empirical events and the way they are linked constitutes the trajectory as a relevant series for the purposes at hand. Therefore, researchers need to find ways to construct rich traces to document the various dimensions coming together into episodes (audio-video data, ethnographic observations, etc.). They also need to consider the modes through which episodes are woven into a chain.

- c) *Trajectories involve bifurcations*: Trajectories do not unfold linearly but involve bifurcations. Thus, while in the concept of trajectory there is the idea of a general “direction”, of a horizon of deployment, this direction can change at any moment under the real-time dynamics that makes up its course. These changes can lead to readjustments of the arcs of work, or create bifurcations and unexpected paths of development.
- d) *The episodes of a trajectory are in relations of co-configuration*: Episodes are moments of mutual interpretation. They both contribute to interpreting what happened in past episodes and to configure what will come next (de Saint-Georges, 2004, 2005; Scollon & Scollon, 2000). Ricoeur calls this power of re-signifying the present a “re-figuring” power. The present is thus both the place where the future of the trajectory starts to be constituted and the place where the past of the trajectory gets re-interpreted in a movement of mutual co-configuration.
- e) *The episodes of a trajectory are points of resemiotisation*: In the process of moving through time and space, gestures, body postures, things, people, representations, discourses undergo incremental or abrupt semiotic or identity transformations. The idea of transition involves both the idea of continuity of the “same” and the idea of possible radical bifurcations and transformations. In looking at learning, one goal is to identify at which points resemiotisation or semiotic transformation occur: where, when or with whom are practices, discourses, etc. internalized? Are they internalized equally for all participants? Are the practices embedded in historical body in different ways for the participants involved? etc. (Scollon & Scollon, 2004, pp. 165-170).
- f) *Trajectories help capturing transitions*: Transitions can be viewed as properties of trajectories. They mark the passage from one episode to the next. They are moments where resemiotization and transformation from a previous episode to the next occur.

In the next section, we reinvest these ideas to define more specific trajectories – “situated trajectories of learning” – on which we base our analysis of the empirical material.

The notion of situated trajectory of learning

Strauss’s conceptualization of the notion of trajectory can in our view be fruitfully applied in the domain of learning and education. We could call the trajectories concerning the dynamic relations learners and teachers entertain with some bit of knowledge *situated trajectories of learning*. Through using this term, we emphasize that our empirical focus is on the ways in which learners engage with knowledge in educational situations. If we apply Strauss’ ideas about the notion of trajectory to learning processes, we can identify a number of elements key to the notion of trajectory of learning. Learning consists in temporally organized processes. These processes are guided by a “trajectory manager” (the teacher) who projects a certain “arc of learning” (the set of things that needs to be done for the learner to be said to have learned the content or practice aimed for). The trajectory goes through a number of phases, in the course of which learners engage with the object of knowledge. This engagement is never a straightforward one. The learner always contributes to the shaping of the trajectory by appropriating it, reconfiguring it, making sense of it in relation to the resources s/he has available at the point of learning (see also Kress et al., 2001). In the process of learning, “debates”, “controversies”, “perturbations” or “bifurcations” occur. The trajectory’s direction is thus always open, fluctuating, and uncertain. Learners are not passive receivers of knowledge, the ones over which the arcs of learning would be imposed, but they contribute agentively to the

development and shaping of the trajectory. Following Strauss again, we can also distinguish the “course of learning” from the “trajectory of learning”. The course of learning is the psychological process of learning, which we do not have access per se. The trajectory of learning is the temporal organization of collective activities aimed at creating the conditions within which learning can take place. For us, to study the trajectories of learning is thus a way to understand better which properties of activities enable psychological processes of learning.

This approach has some roots in the field of school didactics and social psychology (Perret-Clermont, 1980; Perret-Clermont & Nicolet, 2001). It echoes for example the concept of *microgenesis of learning* developed by Saada-Robert and Balslev (2004). Coming from a post-piagetian perspective, the authors argue for viewing learning and teaching as diachronic processes, occurring within a social context of learning and requiring a work of articulation of a shared space of meaning around some object of knowledge. They propose that to study teaching and learning requires taking into account the microgenesis of knowledge: how it evolves and transforms in the course of situated activities of learning and teaching. This microgenesis is a local, dynamic and collective construction in the course of which both teachers and learners come together, structure their interactions around some knowledge and attempt to constitute its meanings collectively and dynamically in these interactions. They show that meanings in the classroom are not more given than in any other interactions although they are structured around an object of knowledge. There are detours and transformations in knowledge circulation resulting from the fact that learners are not necessarily ready to give the same meanings to the events as the teacher. Knowledge is progressively constructed and reconstructed by them. It is not immediately shared although both learners and teachers might want to share it. Learning is thus a process of joint construction of a zone of shared meanings (Saada-Robert & Balslev, 2004).

With the general frame presented up to here, a question remains: how can we operationalize the notion of “situated trajectory of learning” in processing empirical data? What kind of transitions occur in trajectories of learning. In the last section, we would like to move to the discussion of some empirical material to illustrate how the concept of situated trajectory of learning can be useful to study transitional micro-phenomena.

A case study

The data for the case study is drawn from ethnographic fieldwork carried out in a Swiss vocational school, located in Geneva. The corpus was constituted through long-term observations (four months) and engagements with the participants. The part of the corpus discussed here consists in audio-video excerpts documenting moments of teaching/learning in a workshop aimed at a group of future automobile mechanics. This workshop was selected for analysis for two reasons. Firstly, observing the learning of a new technique allowed to trace novice performance of gesture and its evolution through time. Secondly, the fact that the task analyzed deployed itself over a relatively short-time span made it relevant for illustrating the notion of trajectory in a manageable space.

In the workshop studied, nine apprentices are at different stages of learning how to turn a metal plate into a small box. Folding the four sides of the box is a rather delicate step of the process. Indeed, the box must be folded without breaking the side and this implies learning something about the resistance of the metal constitutive of the plate. In our analysis, the focus is on this folding task. The sequence begins with the teacher (hereafter MON) giving a collective explanation to the group of apprentices regarding how to perform the task. The various apprentices then reappropriate the explanation successively and differently. Like in the “bush telephone” play or the “Chinese whisper” game, the explanation transits from the teacher to the learners and from one learner to the next. In this process, the explanation undergoes various fates. Our interest here is to follow these various destinies and examine the temporal development, bifurcations, relations of mutual configurations and resemiotisations in the learning trajectory. In this illustration, we will only take up some excerpts of the trajectory

to give a gist of how it is constituted and what are interesting transitional phenomena across the various episodes constitutive of the trajectory.

MON's explanation

The first episode in the trajectory we would like to consider is the *explanation* given by MON to specify how to fold the metal plate. In this first episode, MON shows that in order to do this one needs simultaneously to exert pressure on the plate with the wrist, give hammer blows on it but avoid leaving marks on the plate. Below is an excerpt from the sequence that gives a feel of the resources used by MON to construct this explanation¹.

(1)

1. MON: when I will exert pressure on my plate/ as I fold it\
 2. (*puts his hand on the plate in preparation for exerting pressure*)
 3. then with my hammer/ (*lifts the hammer*)
 4. I will hit the plate\
 5. (*hits the plate*)
 6. if I simulate\
 7. the force of the hammer\
 8. when it hits the plate\
 9. (*simulates the force of the hammer*)
 10. the hammer blow/ will . misshapen my plate/
 11. if I don't hit in a skillful way/
 12. (...)
 13. see the other side of the box it will gouge\
 14. (*demonstrates the gouging by pressing the hammer on the plate*)
 15. see/ the fold here that has impressed itself/
 16. (*shows the fold on the plate*)
 17. on the top of the plate/
 18. yep



17. MON: thus. to avoid making this gouge MARK\



18. you must/ with the palm of your hand/



19. fold the plate\and then/using the other plate/you must make the mark\



20. you see/ the height that I lifted the hammer/ to blow it/ and it came right\



21. so I begin the fold/



22. by the pressure/ of the hand/ and then I MARK the position of the fold/



23. wi:th a blow of the hammer (action continues)

24. I don't hit it hard/

25. and if I am skilful at hitting/

26. you should not feel marks left by the hammer blows/ here when you touch with your finger/

The explanation given by MON is a rich and complex unit, calling on multiple modes to render the task visible and intelligible. For example, MON uses language (l. 1-23) to help apprentices' access the *sequential organization of the task* (l. 18-19: "you must/ with the palm of your hand/ fold the plate\and then/using the other plate/you must make the mark\"). Language is also used to specify both what should be done – in the form of a normative *prescription* (l. 18-19: "you must/ with the palm of your hand/ fold the plate\and then/using the other plate/you must make the mark\") and what should be avoided – in the form of a *proscription* (l. 9: description of an hypothetical situation "if I don't hit in a skillful way/"; l. 11: "see the other side of the box it will gouge\"; l. 17: "thus. to avoid making this gouge MARK\"). Associated with *pointing*, language also enables MON to highlight salient *artifacts* which will mediate the accomplishment of the action (l. 3 "with my hammer/"; l. 18 "with the palm of your hand/"). Information is also given through other modes. Through their sense of *hearing*, apprentices get to learn what is an appropriate way of blowing the hammer by listening at the noise made by the blows. Through the visual display of a mark on the plate highlighted *gesturally* (l. 17) and being invited to use their sense of *sight*, they learn what the edge they should avoid impressing might look like². The *artifacts* used become organizers of the situation. There is a *convergence* and complementing between the practical activity and the way it is mediated by language. MON attempts to make available the *intelligent* part of work, that which cannot be accessed through imitation alone, pointing at movements of orientation that might fall beyond the radar of attention for the apprentices if they were to just look at the activity without linguistic, gestural, temporal and actional mediation. In organizing knowledge in this way, MON also opens up a certain trajectory for the participants, specifying which tools to use, in what order they should perform the sequence of tasks, what physical strength they should impose on the process, or defining an end-goal for them. He thus also organizes what the contribution of the participants to the collective activity should be beyond the explanation. This explanation is programmatic in the sense that through its utterance the teacher plays the role of a trajectory manager. He projects and designs a certain arc of learning and models through his own actions what actions the apprentices should be performing in the immediate future.

The uptake of the explanation by TER and JUL

Several actions follow this explanation and can be viewed to emanate from it (Scollon & Scollon, 2004). For example, TER and JUL, two apprentices in their third year of training, following the arc of training designed by MON take on the folding task. In this second episode, TER and JUL are working close to each other. This spatial configuration allows collaborative work when confronted with difficulties:

- (2)
- 1.TER: (positions plate)
2. (tightens the vice)
3. (begins to hit the plate with the hammer)
- 4.TER>JUL: hey he said we should hit down so that we don't er hit the plate/ is that right/
- 5.JUL: and at the same time you must fold it like that\ I think\
- 6.TER: with the hand/ (sounding surprised)
- 7.JUL: yea:h@\ I think@\ so\
- 8.TER: so we must do it like this/ (spread his hand on the plate)
- 9.JUL: yeah I think so/
- 10.TER: I am sure that machines exist\ to fold metal plates\
- 11.?: well of course/
- 12.TER: you would just go and buy one at the D.I.Y/ (4 sec.)
13. it costs less\ because given the time and resources used here\
(goes back to hammering the plate)



Figure 2. TER and JUL's uptake

This excerpt occurs after TER and JUL have been each occupied for quite some time at attempting to fold their respective metal piece without any success. The metal resists their attempts at accomplishing the task because they are not exerting pressure with their hands. Faced with this practical difficulty, the two of them initiate a joint resolution of their problem by remobilizing the explanation initially given by MON. The past explanation thus gets reconfigured and transformed. If we recall it, MON's explanation went as follows:

21. so I begin the fold/
22. by the pressure/.of the hand/and then I MARK the position of the fold/
23. wi:th a blow of the hammer

In the version of the explanation jointly produced by TER and JUL (l. 4-9), the certainty of the tone has been transformed in an hedged version of the proposition (l. 4 "er", "is that right?"; l. 5 "I think so"; l. 6 (sounding surprised); l. 7 "I think so"; l. 9 "yeah I think"). Both these markers of uncertainty and the fact that the task could not be accomplished signal a problem in the understanding of the task. It seems that what has not been grasped is the double movement of both exerting pressure on the metal while using the hammer in a light way to accompany the folding of the metal without marking it. In the reported speech of TER, the bit of the explanation that dominates is that the hammer plays the most important part in the folding of the plate (l. 4: "hey he said we should hit towards below so that we don't er hit the plate/ is that right?"). JUL's contribution is to highlight the importance of the hand pressure (l. 5: "and at the same time you must fold it like that\ I think\"; l.6 "with the hand/ (sounding surprised)"; l. 7. JUL: "yea:h@\ I think@\"). The two apprentices are able to identify the right tools, to perform the task in the sequence suggested but they miss an important part of the explanation, and still find themselves unable to fold the plate. Cognition appears distributed over the two individuals and the object of knowledge not yet integrated or understood at this point.

The recycling of MON's explanation to TER and JUL

Despite their exchanges, TER and JUL find themselves unable to accomplish the task. As time goes by, they start giving stronger and stronger hammer blows on the plate. The noise they make alerts MON who moves towards them to stop them, as illustrated by episode 3:

(3)

1. MON: eh kids I think you're hitting too hard\
2. look you're- you're almost cutting the plate\ you see there/
(points at the fold)
3. you- you're not DRAWing it down enough with your wrist/
4. (exerts pressure with his finger on the plate)

MON's intervention signals the breaching of the prescription he intended to be followed when programming the trajectory of learning. The trajectory of learning planned by him has temporarily transformed. Three elements are resumed in the recycled explanation: the strength of the blows, the danger of gouging the plate and the necessity of using one's palm to exert pressure on the plate. Here in fact, it is the wrist that is presented as the appropriate folding tool.

5. TER: ah/ we can- we can push it there/
(exerts wrist pressure on the plate)
6. MON: YOU MUST/ EH I SHOWED YOU/ THAT\
7. because see here\
8. you see the line/ that has impressed itself/
(points at the line with his finger)
9. JUL: (stops hitting with the hammer and comes closer)
10. TER: yeah\
11. MON: er/ you must PUSH with with the forearm or the wrist/
(exerts pressure on the plate with his finger)
12. to fold the plate/
13. and in addition/ the- the hammer blow/
(points the line with his finger)
14. see how intense it is/ look here/ at the edge of the plate it is all squashed\ (shows the squashed plate)
15. JUL: but here in fact/ (points to the line with finger)
16. MON: it's your arm that folds the-/
17. JUL: but here\
18. if we squeeze here too much/ (points the line with his finger)
19. here it will create a gap at the joint after\
20. MON: if/
21. JUL: if we squeeze too much here\
22. JUL>TER: put your plate there\
23. MON: but OF COURSE it will create a gap\
24. JUL: it creates a gap\
25. MON: but you- you will compensate for it towards the end/
26. when er you are at 88° I don't know/
27. JUL: (returns to his bench)
28. TER: (starts hitting with the hammer)
29. MON: PUSH MORE with the arm\
30. TER: still more/
31. MON: with your arm MORE/
32. TER: (hits the hammer)
33. MON: is it folding now/ do you feel it/ is it coming better/
(gestures with his hand)

JUL and TER's reaction to this second explanation clarifies the difficulty they are faced with. JUL is afraid of creating a gap by squeezing his plate (l. 17-22). But MON's indicates that this is a false problem: the gap can be corrected in the end (l. 23-26). Despite the explanation, it takes one more round of insisting on the necessity of pushing with one's arm (l. 29-31) before the apprentices integrate the appropriate gesture in their work and the plate starts to fold.

In terms of the trajectory of learning, the episode presents a number of characteristics that differ from the first explanation. Firstly, it differs notably in its configuration, by moving from a "one-to-many instruction situation" to a "one-to-one explanation" to TER and JUL.



(1) Episode 1 : Collective explanation



(2) Episode 3 : Explanation to two apprentices

Figure 3. Semiotic transformation of the initial explanation

From moving to a collective and general explanation of the steps to take, to an explanation tailored to the local needs of the apprentices, several indexical landmarks have changed. While the first explanation was a demonstration done both on the verbal and the actional mode and performed largely by MON, the second explanation is made in a strictly explicative posture. To notify that the apprentices must draw the plate towards them, MON makes the mirror-gesture of pushing the plate forward. He accompanies verbally the accomplishment of the task and uses gestures only to point at the most significant piece of information that was lost in the first explanation. This change in posture (from "actor" to "guide accompanying the action") is also marked in the clothing worn by MON. He has dropped his overall and wears a shirt, signaling his non-engagement in the "dirty work" of accomplishing the task. A common understanding of the task thus starts to be construed at this point. When JUL and TER have identified their problem and a legitimate solution/explanation has been given to solve it, the apprentices are finally able to perform the action smoothly. Their own engagement as actors in the task but also the targeted mediating help of MON have helped overcome the learning obstacle.

The recycling of the explanation by MON is thus not a simple repetition. Through it, MON both resignifies (reconfigures) the past explanation, transforms it through resemiotization (he does not perform the action himself but mimics it through gestures, thus transforming the semiotic register used). This resemiotization configures a new development in the trajectory since it allows the accomplishment of the task by TER and JUL. It is thus in the relation between the episodes that the transition between an unsuccessful gesture and a successful one starts being constituted. Other apprentices still fail however to succeed in the task as we see in the next section.

Uptake of MON's explanation by SHET

MON's arc of learning does not concern only TER and JUL but all the apprentices present in the workshop. Each of them has his own way of making sense of the explanation. SHET is another apprentice that engages in the folding of the plate. When episode 4 begins, several apprentices (RUB, TON, SAR, & JUL) are gathered around his work, evaluating it:

(4)

1. RUB>SHET: you too does it show like –
2. OHHH fU:::CK/
3. TON: @@@@/
4. SHET: oh shit\ it slipped\

5. TON: eh RUB @@/
 6. ar look at it it's worse than mine man\
 7. he has really beaten the shit out of it\
 8. (*a small group assembles to look at the plate*)
 9. SHET: it slipped so\
 10. SAR: it slipped\ it's true I swear to god\
 11. it's true\
 12. ??: it's true\
 13. RUB: fuck it looks like it's cut man\
 14. ??: don't pretend\
 15. SHET: what/
 16. RUB: it looks like it's cut there/
 17. TON: oh yeah @ but don't HIT IT SO HARD/
 18. SHET: (*keeps on lowering the plate without using his wrist to push it down*)



Figure 4. SHET's uptake

Two comments are in order. Firstly, we see that here again MON's explanation has undergone transformation in the process of being re-appropriated by SHET. SHET experiences the same problem as JUL and TER: his plate does not fold. This time, however, there is no timely intervention from MON to prevent the marking of the plate. As a result, his plate is full of marks and gouges. Secondly, the fact that the other apprentices take upon themselves to criticize his work displays their own understanding of the proscription. There should be no mark impressed on the plate. (l. 6 : "ar look at it it's worse than mine man"; l. 13: "fuck it looks like it's cut man"; l. 16 "it looks like it's cut there/"). They display also knowledge in assessing that the hammer blows are responsible for the marks (l. 17: "oh yeah @ but don't HIT IT SO HARD/"). We see here that by being put into action, knowledge does not serve only the purpose of successfully performing a task, it is also a means of displaying expertise and thus of playing up interpersonal relationships. Between the initial instructional episode and SHET's uptake of it there has thus been a reconfiguration. Knowledge is not used as instruction to perform a task but as a ritual instrument to position oneself in a group. Moreover, the instructional discourse has been resemiotized. The initial proscription, specifying verbally what should not be done, has now been absorbed and transformed into visual marks on the plate.

JUL's explanation to SAR

The trajectory of the explanation does not end with SHET's inability to perform the task. Several other apprentices turn out to be more or less successful in the folding activity. We would like to mention however one last episode in the development of this trajectory. In the fifth episode, SAR encounters the same difficulty as JUL and TER had before him. JUL, noticing this difficulty, takes upon himself to circulate the information regarding the hand pressure gesture:

- (5)
1. SAR: *(looks at the plate, perplexed)*
 2. JUL>SAR: *(shows how to exert pressure with the hand on the plate)*
 3. xxx
 4. JUL: xxx
 5. SAR: I must hit it here once/
 6. JUL: yeah so that it helps push it down\
 7. and after to mark the angle you hit it a bit more towards the angle\ xxx
(SAR begins to push on its plate)
 8. come on push push it a bloody hell more\
 9. xxx
 10. *(JUL replaces SAR and exerts pressure on the plate)*
 11. SAR: wait wait w-/
xxx
 12. JUL: come on you must push\
 13. *(moves away)*
 14. SAR: *(hits and pushes simultaneously)*
 15. JUL: *(comes back and observes)*
you see it already leaves less marks\



Figure 5. Recycling of the explanation by JUL

At this point of the trajectory, there is a change in participation format. JUL moves from being the receiver of some piece of information to engage in relaying that information to someone else. He thus becomes himself a trajectory manager for the microactivities of SAR and becomes the origin of a new explanation. In this explanation, he re-figures the explanation given in the past by MON while at the same time contributing to organizing SAR's action. Much like MON had done in the first explanation, JUL begins by giving a demonstration of the gesture to be performed, then as in MON's second explanation he retreats to let SAR engage with the activity himself. But when SAR appears reluctant to exert pressure on the plate, JUL intervenes physically to encourage him to push harder and insist verbally on the importance of pushing more (l. 12. "come on you must push\"), thus accomplishing the equivalent to MON's "PUSH MORE with the arm\" (l. 29); "with your arm MORE/" (l. 31) in episode 3. In this swapping of animator (Goffman, 1959) for the explanation, there is also a move from a more formal and instructional discourse (that of MON) to a more familiar register for the apprentice (l. 8. "come on push push it a bloody hell more\"). This close guidance allows SAR to perform the task successfully.

Discussion

A few key points can be summarized from this section. Firstly, we can see that, overall, knowledge transits across individuals in time and space. It is both individually appropriated and collectively constructed. Secondly, we see that giving an explanation, instructing someone

to do something is not just the way some knowledge circulates. It is also a form of action in the world. By projecting a certain trajectory, it is hoped that the individuals following that trajectory will be able to perform some task in an autonomous way. Thirdly, the excerpts shown display that teaching in the context of vocational education is not something that the teacher does alone. There are multiple actors, which in different forms take on the role of trajectory managers as their peers experience difficulties in the domain where they have acquired expertise. Expertise is defined here in a very practical way, as the ability to reproduce a task successfully after having experienced it. Fourthly, we see that close guidance is the way in which knots in the trajectory get untied for the apprentices. The intervention of MON or a peer leads to a resolution of the problem. Fifthly, from the multimodal examination, it appears that all the apprentices stumble upon the same difficulty, that of knowing to exert pressure to fold the metal. Some have rational reasons for not engaging in exerting pressure (JUL, excerpt 3, l. 17-22). Others are afraid of breaking the plate (SAR). Yet others understand the hammer to be the principal lever of the action (SHET). This commonality of problems leads us to a hypothesis. The “pressure gesture” is the only one that apprentices cannot experience for themselves in looking at MON’s first explanation. While they can hear the hammer and see the marks it may leave, they cannot “see” the pressure exerted by MON and thus this gesture flies below the radar for them. It is only in their subsequent engagement with the material themselves that this problem becomes apparent. The case thus also illustrates the importance of engaging apprentices with their five senses in action. Finally, as the various apprentices appropriate knowledge, we see how it undergoes semiotic transformations. There are role, register, contextual, and linguistic changes. In the course of these transformations and transitions across episodes, we see incremental learning processes being negotiated.

Concluding remarks

This research on transitions aimed at fulfilling empirical, theoretical and methodological goals.

On the empirical level, we have proposed to conceive transitions as indexed to situated trajectories of learning. We have observed various kinds of transitions in our data. There were the transitions in participants’ framework and the ways in which they affected the configurations of the activities across the various teaching/learning episodes. There were the transitions undergone by the object of knowledge circulating in the educational context and how it got transformed and reconfigured by the different participants at different points in time in the unfolding of the workshop. There were also the discrepancies identifiable between the trajectory of learning projected by the trajectory manager and the actual trajectory of learning for each individual resulting from the emergent circumstances of the work. In addition, the semiotic resources available for making sense of the activity of folding fluctuated from one episode to the next. Sometimes, language was put in the foreground; sometimes other modes were taking charge of the explanation. On the other hand, discourse was often the relevant resource to accelerate or facilitate understanding when there was a misunderstanding regarding the technical gesture to be performed. Discourse alone was not sufficient however to successfully perform the task. Experimenting first hand the material’s resistance also needed to be taken into account for learning to occur.

On the theoretical plane, the case study illuminates in our view the *microdynamics of educational situations* in their complexity, affecting people, objects, discourses and actions. This microdynamics of education shows that learning is always contextualized within specific activities and indexed to specific semiotic spaces. It is a dynamic process, consuming time and organizing time in certain ways that cannot be short-circuited. The study shows that learning is also a collective process, engaging members of a group in different ways, according to their expertise and background. In this collective dynamics, some individuals have privileged access to resources (those who benefit from explanations one-on-one, those who receive

explanations in a timely fashion in relation to where they are in their own course of activity, those who offer explanations to others) and others are marginalized (those who are kept out of the re-semiotisation loops or deprived of timely contribution to refigure their actions).

Finally, on the methodological plane, taking the notion of “situated trajectory of learning” as our unit of analysis has moreover allowed us navigating between two contradictory but essential methodological requirements. Looking at trajectories in our view allows both grounding the analysis in the study of real-time, concrete, situated actions as they unfold in their moment-by-moment accomplishment by the actor. It also allows us “opening up the circumference of the analysis” (Scollon & Scollon, 2004) and going beyond the units traditionally studied either in sociolinguistics or in vocational education. The notion of “transition” thus appears as a fruitful heuristic tool to think about the link between micro and more macro organizations of learning. Further studies should help refining our understanding of how activities, identities and discourses develop and evolve through time. These studies should help us understand better the cumulative effects of our actions on our identity and knowledge and how as actors we are able to construct linkages between activities from days to lifetimes and across various settings.

Appendix

Transcription conventions (adapted from Mondada, 2005)

(.) or (..)	=	pause
(Ss)	=	longer pauses
(a:)	=	vowel lengthening
(-)	=	interrupted segment
(/)	=	rising tone
(\)	=	falling tone
(CAPitals)	=	accentuated segment
(<i>action, movement or gesture</i>)	=	non-verbal behavior
(XX)	=	unintelligible segment
(??)	=	unidentifiable speaker
<u>underlined segment</u>	=	overlapping or co-occurrence with depicted visual
@	=	laugh, laughing quality of voice

Notes

- ¹ Excerpts are translated from French. For transcription conventions, see Appendix.
- ² For a discussion on the uses of the five senses in vocational education, see also Filliettaz and de Saint-Georges (2006) and Filliettaz (2007).

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Cet article porte sur les micro-phénomènes transitionnels à l'oeuvre dans les processus d'apprentissage des métiers en formation professionnelle initiale. Sur le plan conceptuel, il propose d'envisager les transitions comme des états intermédiaires de trajectoires situées d'apprentissage plus larges. La notion de trajectoire située vise à rendre compte d'une double dimension des processus d'apprentissage: (a) leur caractère situé et hautement contextualisé, et (b) leur inscription dans des trajectoires temporelles. L'article commence par développer la notion de trajectoire située d'apprentissage comme unité d'analyse avant d'en tester la pertinence au travers de l'analyse d'une séquence d'enseignement/apprentissage documentant des transitions et des transformations d'un objet de savoir enseigné dans le cadre d'un atelier de mécanique. Au plan théorique, cette contribution propose de considérer les transitions comme des micro-dynamiques inductrices de changement. Au plan méthodologique, il contribue à identifier des concepts et outils méthodologiques pouvant servir de ressources pour tracer des transitions dans des données empiriquement attestées.

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