A user-centered ergonomic approach to CALL\textsuperscript{1} Research
Françoise Raby

In this chapter, under the heading "overview" I shall introduce key concepts in ergonomics and the educational ergonomic construct that serves us to investigate CALL settings and activities; then, under the heading "previous research", I will present the different investigations we have carried out about CALL environments and self-regulated learning, using cross-checking method which I have elaborated. The CALL environments we have investigated include the self-access rooms of language centres, (whether in higher or secondary education) or CALL classes in secondary education.

Introduction
One day, I was supervising my students who were working autonomously on their written comprehension in the self-access room of my language centre when I realized that Johanna had chosen to work on an old grammar program bought about ten years earlier. It consisted of multiple choice questions about grammar rules. I came up to my student saying "Tell me Johanna, what are you doing there?" She replied "I am working on my comprehension" Rather puzzled, I went on: "Your comprehension? But this is a grammar program, not a comprehension one and, besides, it is rather daunting, isn't it?" "Well" she said "I find it very good to improve my comprehension. I don't use it to learn grammar but to learn idiomatic expressions and how to build up sentences properly. You see, when I read a text, for instance, on the Internet, after a while it gets on my nerves, it's too difficult for me to understand and I am not really sure that I have guessed the right meaning, whereas here, when you can't understand an item, you ask for the translation and so you know for sure what it means and you can note it down and learn it. I have really learnt a lot of expressions with this program." (My emphasis, F.R.)

Johanna's story has convinced me of two things that have guided my approach to CALL research ever since: first that "in the House of CALL, there are many Strategies", not just those

\textsuperscript{1} CALL should not be taken here in the literal meaning of the acronym; it designates all foreign language teaching and learning situations which bring into play information and communication technologies (Davies, 2001).
planned by teachers; secondly, that if we want to improve CALL environments, we should go and have a look at what actually goes on in real foreign language classes resorting to CALL.

Overview
In the limited space of this chapter which is meant for CALL readers and not for specialists of work analysis, I will try to give an insight into what cognitive ergonomics can bring to CALL research (namely much more than imagining a pen best designed for comfortable writing, which I thought it was before I discovered this discipline).

Ergonomics comes from the Greek *ergon* (work) and *nomos* (law, rules). Ergonomics seeks to establish the rules that govern men and women activities while at work. In psychological ergonomics the latter are designated as operators, and the qualifying term *operative* refers to the psychological features of operators' activity. Everywhere, in firms, factories, services and in the educational world too, there are machines which are getting more and more sophisticated.

Ergonomics is a unifying discipline which seeks to describe and interpret men/machines interactions (D.Cornfield & al, 2003). To simplify things, we can say that there are two main schools in ergonomics: the American and the European. Although they may seem contradictory in their approach, they are, in fact, complementary. The older one, but by far still the most influential, is the American school, also called the human factor school, which studies the general characteristics of men and women in order to find better ways of adapting machines or technical environments to these characteristics (Wickens et al, 2003; Bridger, 2003; Stanton & Young, 1999). The second school, more European, sees ergonomics as the analysis of the activity of specific operators carrying out specific tasks in the field, that is to say in their work normal work settings (Montmollin, 1984; 1996; Almaberti, 1991 & 1998; Hoc, 1992 & 1996; Leplat et Hoc, 1983; Leplat, 1997). The current tendency is the merging of the two trends -the
human factors trend being more and more interested in actual usages and the European school with design (Montmollin, 1992; Caroll, 1991, Frascara, 2003; Jordan & Jordan, 2000).

EDUCATIONAL ERGONOMICS

During the past 15 years, our research team has been applying the constructs and methods developed in ergonomics to learning and teaching situations (Raby & Dessus, 1998; Rogalski, 2000).

In most ergonomic surveys carried out by the French school, the study of work environments is grounded on the theories of mediated activities (Leontiev's activity theory, 1988; Vygotsky's theory of the instrument, 1986; Piaget's genetic psychology, 1963 & 1965). One main idea conjointly developed by these authors has largely been disseminated in CALL research: the notion that we learn and change thanks to our interactions with our environments, in other words that knowledge is socially and culturally embedded (Vygotsky, 1978; Rabardel, 1995a; Bandura, 1977a & b). Another tenet developed in the wake of activity theory, is Vygotsky's (1988) and Rabardel's (1992 & 1995) theory of the instrument. This theory encompasses material objects, artifacts, tools and instruments and seeks to explain how the appropriation of learning instruments brings into play collective schemes of usage. Schemes express the biological capacity of any subject to assimilate new objects, new situations. The concept of scheme is pretty close to that of frames, schemata and scripts (Minsky, 75; Shank & Abelson, 1977; Hoc & Nguyen, 1987). A scheme is both a biological structure and an active organization of our experience which integrates the past and which evolves as it becomes adapted to new situations. The scheme of an action, for instance writing a letter on a computer, is made of all the characters of that situation (P.C. or Mac, resources, editing applications, editing tools, letter templates, etc.) which are permanently related into a coherent frame or representation. Schemes being biological
structures they cannot be approached directly, the researcher has to hypothesize their presence, indirectly. One characteristic of a scheme is the fact that once assimilated (Piaget, 1965), its characters become fixed and the scheme can be applied to other situations (for instance, writing reports, and not letters, with the computer). When appropriating CALL environments, learners and teachers develop schemes of usage. Once these schemes have become regular and stabilized they become rules of usage. The notion of usage, as different from use or utilization, indicates that these strategies are socially and culturally rooted (Rabardel, 1995; Resnick, 1985).

If cognition evolves, as genetic epistemology has shown, through interaction with the environment, then it can be expected, in the course of its genesis, to have accommodated to particular specific functional and structural features which characterize artifacts. Does this have an effect on cognitive development, on knowledge construction and processing, on the nature itself of the knowledge generated? If so, through what macro and micro-genetic processes can this effect be thought to be actuated? (Rabardel & Vérillon ibid: 77)

Rabardel (1995,b) and Bruillard (1998) also claim that in any training environment the subjects' cognitive systems are never directly connected to the target domain and that the use of instruments during the working process generates a mediating process which affects the very content of the language which is being acquired. In CALL contexts, as will be seen later, another dimension should be added, that of the environment or system, which is more precisely labeled in French by the term dispositif (Chapelle et al, 2003; Raby, 2003; & in preparation).

**Learning environments as dynamic systems**

With the increasing complexity of workplaces in the past fifty years, a new domain of investigation has been developed in the ergonomic field, that of dynamic environments (Hoc, 1996) which, precisely, corresponds to CALL environments.

A self-access room, for instance, is a dynamic environment, characteristic of the complexity of most present work situations. Ergonomics describes these situations as highly dynamic, which
means that they are able to undergo some modifications without the actors acting upon it. To prepare would-be teachers to that kind of work situation is to provide them with a repertoire of solutions/decisions to cope with all kinds of incidents, failures, unexpected answers (good or bad) or behaviors etc. As for students, the tutor's work in a self-access room consists in helping them to build up their own learning strategies (Raby, 1997). Generally speaking, CALL environments, because of their instability, either technical (some computers are out of order, or the network has broken down) or pedagogical (they generate new forms of work) are highly dynamic from the point of view of the learner and, therefore, potentially disturbing (Raby 1997, 2003 & in preparation; Scardamalia & al, 1994). Besides, our research has shown that during the working process teachers or learners tend to obliterate or adapt those parts of the learning environment which, in simple terms, do not suit them or worries them. An example was provided by two pupils who were doing an audio comprehension task on a CD ROM (Raby et al, 2003). At a certain point, they found themselves in difficulty in their comprehension of the document; so, as the teacher was not paying attention to them, they clicked on the script key of the program, thus turning audio comprehension into written comprehension. We have used the ecological concept of niche to define the milieu designed by learners or teachers to protect themselves from the potentially disturbing traits of their dynamic environment (Raby, 1997).

**Instrumental genesis**

The concept of instrumental genesis is at the core of our work. It is derived from Piaget's genetic epistemology. The term "genesis", here, implies a developmental theory of knowledge (Campbell, 1997). Piaget believed that the development of knowledge was a biological process, a matter of adaptation by an organism to an environment. When dealing with instruments, the
same progressive adaptation takes place, and this why it is named by Rabardel (1995) instrumental genesis.

Instrumental genesis is based on the distinction between the learner’s environment and the learner’s milieu. A learner’s environment ranges from society to institutions (schools, universities, curricula) to specific workplaces like the foreign language class. It is made up of both material and symbolical elements. The concept of milieu is necessary to explain how an individual appropriates a work environment. One given work environment is here, one can not change it. For instance, if there is no computer available in the self access-room, a learner won't be able to work; if one particular teacher is here, acting as a tutor, and the learner does not like him, he can't tell him to go away! Etc. In contrast, the milieu should be seen dynamically as the product of the subject’s responses to the stimuli triggered by the environment and vice versa. In the case of a CALL environment, like the self-access room we have been investigating, it includes cultural, institutional, technical and didactic systems which interact and, of course, influence the learner's actions. To work in a CALL environment means to select and adapt parts of this environment but, conversely, the stimuli coming from the learning environment select such or such procedure in the subjects' mental repertoire of possible actions. For instance, if learners are chatting through the web in a collaborative form of work, they never actually need to use all the computer's functionalities and applications; on the other hand, the fact that they have to chat on the web, and not to write an essay, triggers off the kind of mental operations specifically suited to that sort of task.

By interacting with a specific part of the self-access room, learners create their own specific learning milieu, a sort of niche, as mentioned earlier. As they inquire, change instruments, take notes, consult different aids, take breaks, etc. they develop instrumental behaviors. Instrumental
behaviors are behaviors which reveal the way in which learners or teachers organize and regulate their work. They give some information about the mental work which is underway, e.g. the learning or teaching strategies which are implemented (O'Malley & Chamot, 1990).

FROM "WORK SITUATIONS" TO "CALL SITUATIONS"

CALL environments from an ergonomic point of view

At the most general level, I suggest distinguishing two work situations: the professional and the training situation.

![Figure 1 Work situations]

In educational ergonomics, as in many field studies, the relevant level for empirical analysis is that of the work situation. The reason for this is that a work environment is too rich and complex to actually be observed. The level of work analysis suitable to observation is that of the work situation as shown by Leplat and Hoc in a seminal article about the Task/Activity model (1983). These authors define work situations as the association of a subject and a task in set conditions. For instance, one example of a CALL work situations could be the association of

- a learner
- and a task: audio-comprehension,
taking place in set conditions: the computer room of a high school equipped with 15 P.C., under the guidance of a teacher acting as a tutor.

But work situations in educational ergonomics are necessarily learning and/or teaching situations. The two perspectives are united in the concept of training situations. When teachers and learners are communicating in a class, they communicate in a working context, whereas, if the same learners or teachers are communicating at the pub they are communicating in a spare time context. The difference is that, in the first case, their conversation is constrained by didactic, academic and institutional rules, whereas in the second case these constraints are missing.

![Diagram of work situations to CALL situations](image)

Figure 2 From work situations to CALL situations.

The following table seeks to pinpoint what actually distinguishes a training situation from a professional work situation. This general concept of a training situation, which becomes even more specified in the case of CALL, has served us as a model to which CALL situations are compared.

**Comparing a professional foreign language situation to a CALL training situation**

<table>
<thead>
<tr>
<th>WORK SITUATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Association of a subject and a task in set conditions</td>
</tr>
</tbody>
</table>

14/12/2003 18:59
### Goals
- **Professional foreign language situations**
  - Essentially procedural: to achieve more or less complex actions using a foreign language.
- **CALL training situation**
  - Epistemic: to acquire language competence.
  - Procedural: to apply the four competences in communicative situations.

### Knowledge
- **Professional foreign language situations**
  - Essentially procedural or operative knowledge.
  - **Operative knowledge**: a procedural knowledge applied in a specific work situation.
  - **Technical knowledge** about the instruments.
- **CALL training situation**
  - Epistemic and procedural:
    - **Epistemic**
      - Learners acquire declarative knowledge: know about.
    - **Procedural**
      - Learners acquire procedural knowledge: know how.
  - Three **tasks domains** are necessarily involved:
    1. **The foreign language domain**: the language which is being acquired.
    2. **The technical domain**: the computer, TV set etc.
    3. **The content domain** of the task: what the document is about or what my interlocutor is talking about. Everyday life, culture, civilisation etc.

### Actors
- **Professional foreign language situations**
  - Operators, employees, staff…
  - The working population
- **CALL training situation**
  - All sorts of populations: Children, teenagers and students
  - Adults in vocational training
  - Senior citizens etc.

### Tasks
- **Professional foreign language situations**
  - Achievement of a succession of physical or mental operations necessary for the professional goal to be completed. The foreign language is used as an instrument to communicate with foreign people or translate documents etc.
- **CALL training situation**
  - **Academic tasks**: Discovering ➔ understanding ➔ memorizing ➔ recalling ➔ applying the foreign language
  - **Communicative tasks**
    - Applying the newly learnt language to genuine situations ➔ simulations.

### Time Variable
- **Professional foreign language situations**
  - The time variable fixed by the management: it is constrained.
- **CALL training situation**
  - Tasks are broken down in order for learners to progressively automate their procedural knowledge.

### Performances
- **Professional foreign language situations**
  - They are the concrete form of the goal. It is **Pragmatically oriented**.
- **CALL training situation**
  - **Academic** when the performance is addressed to the teacher (low motivational).
  - **Communicative/pragmatic** when the...
| Instruments | Serve to achieve a pragmatic goal. Most of the time, the mastering of instruments is a prerequisite to being hired in a professional situation. Ex: if you are to work as a receptionist in a hotel, it is better to know how to use a computer or a switch-board beforehand. | The training process involves the discovery and mastering of two kinds of instruments: the technical and the language one. Learners, develop schemes of usage centred on the functioning of their instruments (ex: knowing how start a computer, how to use an application or a menu). They also develop schemes of usage centred on the finality of the instrument (ex: knowing how to use the computer for a specific learning purpose). |
| Control | Procedural: Self-regulative procedures during task achievement In the end: appreciation of goal achievement. Have the conditions been respected? | Academic: focused on the knowledge/mistake pair. Communicative: focused on the achievement of the communicative goal achieved, even though there maybe some mistakes. |
| Evaluation involves the participation of the operator. Evaluation consisting in contrasting the evaluated activity to a user-centred model of reference of the same activity (Leplat, 1997). | Analysis of the behaviors and the strategies implemented. Then comparison to a task model of reference carried out with the participation of the professional worker. | Evaluation in a FLC involves reflexive thinking on the part of the learner through questionnaires or interviews. Have they achieved their goals? To what extent? What difficulties did they meet with? What competence did they implement? How do they evaluate their motivation? Why? What complementary knowledge do they now need? What conditions should be changed? Etc. (Viau, 1997; Dornyei, 2000 & 2001) |

Figure 3 Professional foreign language situations versus CALL training situations

THE MODEL OF THE TASK/ACTIVITY PAIR IN A TRAINING SITUATION

A work situation can also be examined in the light of the task/activity pair elaborated by Montmollin (1986). Although this model needs to be qualified in the case of dynamic
environments, it is a good starting point to look at the FLC and more specifically at CALL situations.

Figure 4: A descriptive model of the task/activity pair in a CALL learning situation (adapted from Montmollin, 1986)

**Task: what is planned**

Task belongs to the realm of prescription, of norms. It is a group of set goals in set conditions. Task analysis demands that the goal should never be presented without the procedures or skills necessary to achieve it. The task constraints should also be specified (Annett, 2001). In academic
situations they are usually, but not always, defined by the teachers. Constraints consist of the temporal and organizational aspects of the task, together with the modalities of work (individual, in groups, collaborative work, distant work...) and its evaluation (control versus evaluation, self-evaluation versus teacher evaluation, etc.). The problem, sometimes, in CALL training is the fact that task conditions and constraints are not explicit enough, or not sufficiently clear and consistent from the point of view of the learners, thus creating some disorder in their regulation of the task. For instance, what procedures should they use? What instruments are at their disposal? How much time do they have? What is the length of the expected production? Etc.

**Activity: what is going on while subjects are at work**

Once in the field, researchers seek to pinpoint discrepancies between task and activity, to analyse them and to interpret them. Most of the time, they come out with three possible conclusions: a) the task was well-planned, but the students did not have the necessary competence to perform it, in which case the students should be given the necessary knowledge or training; b) the task was well-planned but the students found other ways of realizing it (these unexpected procedures are sometimes called *catachreses* (Rabardel, 1995; Raby, 1997); and finally c) the task was badly-planned and the teacher had better revise it.

**Redefinition of the task: a dynamic model**

In order to partly account for tasks/activities discrepancies, Leplat has also elaborated the concept of task redefinition. It accounts for the temporal characteristic of the working process, the way in which, all along the process, the task is reevaluated and altered. It starts with the level of the task to be performed, which remains general since it comprehends long term objectives conveyed in the form of syllabus or curriculum. The expected task is situated at the level of work situations, it corresponds to the task defined by the teacher: what kind of training situation should
he elaborate to fulfill curriculum demands? What task should learners be given for this particular session? What conditions: length of the production, provision of help, peer or individual work? After this, the students receive their instructions about the task they are going to carry out, and the process of task redefinition begins. Task redefinition, on the part of learners depends on the level of explicitness of the task: the less explicit the constraints, the greater the learner's autonomy; but it also depends on the learner's prior knowledge of the domain (Saks, 1988; Raby, 1997 & 2003). It also depends on the social and personal value (Wood, 1988; Thark & Gallimore, 1988) subjects attach to task achievement, a question which is tackled by modern currents such as situated cognition (Rogoff & Lave, 1984).

To conclude on the concept of task redefinition, it is necessary to insist that discrepancies between the prescribed/expected task and the redefined task do not necessarily reveal flaws – flaws in the pedagogical system or flaws in the learners' knowledge or behaviors, or, again, flaws in the teachers' competence; it may simply attest to people's independence and autonomy (Almaberti, 1991; Raby, 2003 and in preparation). Indeed, in the case of self-regulated learning and self-access environments, discrepancies are even rather desirable as they tend to show that the staff, designers of the CALL environment, have anticipated their learners' differences and allow them to display their own diverse strategies.

Previous research

This presentation will not follow a chronological order, instead it will serve to illustrate the cross-checking method which we have elaborated to study and evaluate CALL environments. First, it should be clear that there is nothing original about the data extracted and processed in educational ergonomics, since all researchers who desire to carry out an empirical research on
CALL will either observe, or interview, or look at productions and interactions (Chapelle, 2000; Levy; 1997; Chapelle et all, in preparation). Yet, the method that we use has specific traits:

- We start with what people do, not what they think or feel, which comes later since we believe that the only data we have a direct relation to are behaviors;
- As often as possible we associate qualitative and quantitative studies since we believe that they are complementary: performance and process are of interest.
- We take into account non linguistic variables especially the physical, social and psychological ones.
- We try to work as much as possible on rather long periods, which means a minimum period of 6 to 8 months, more if possible to confirm and stabilize our findings.

The cross-checking method

While I was working on learners' strategies, I had been through a number of studies based on questionnaires and interviews and I thought that something was missing. Then, looking at our students working autonomously, I realized that in order to get an accurate account of a training situation, both structurally and dynamically, I should structure different data, both qualitative and quantitative, into a coherent framework. This led me to ask for the help of other researchers from different disciplines better armed to study this or that aspect of students' activity. This is what our method has in common with the approach of triangulation. Triangulation postulates that by combining multiple observers, theories, methods, and empirical materials, researchers can hope to overcome the weakness or intrinsic biases and the problems that come from single method, single-observer, single-theory studies. (Jacob, 1990; O'Malley & Valdez Pierce, 1996; Wiggins, 1998).
Three main data are essential for the construction of models of CALL usages: physical behaviors, performances and verbal behaviors. Physical behaviors, because they give useful information about what subjects have to do to carry out their tasks; performances (or productions) when one is interested in knowing how much has been taught and learned; verbal behaviors because what learners or teachers say they feel or think is what enables the researcher to make sense of their physical behaviors and their performances.

**Behavioral data**

**Behavioral data in learning situations**

When we start investigating a specific training situation, such as autonomous computer assisted learning, we usually start with recording behaviors, using either human observers or, better nowadays, video recordings. They give us a first set of results in the form of patterns of behaviors. Here are the different kinds of behaviors that we had selected to compare students working autonomously in a multimedia environment.

<table>
<thead>
<tr>
<th>Media selection</th>
<th>Instrumental behaviors</th>
<th>Work duration in mns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer</td>
<td>Preliminary inquiry</td>
<td>W1= less than 5</td>
</tr>
<tr>
<td>Video</td>
<td>Has breaks</td>
<td>W2 = between 5 and 10</td>
</tr>
<tr>
<td>Didactic printed documents</td>
<td>Takes notes</td>
<td>W3=between 10 and 20</td>
</tr>
<tr>
<td>Newspapers</td>
<td>Communicates with peers</td>
<td>W4=more than 20</td>
</tr>
<tr>
<td></td>
<td>Seeks for content help</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Seeks for material help</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Uses a dictionary</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Instrumental behaviors displayed while using educational technologies in a multimedia environment (Raby, 1996).
We, then, processed the grids into descriptive statistics, comparing students who belonged to the guided autonomy class (GA) to those coming of their free will (NGA).

<table>
<thead>
<tr>
<th>media selection in %</th>
<th>Students in guided autonomy: GA</th>
<th>Students working on their own: NGA</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer</td>
<td>33</td>
<td>23</td>
<td>56</td>
</tr>
<tr>
<td>Video</td>
<td>28</td>
<td>36</td>
<td>64</td>
</tr>
<tr>
<td>Audio</td>
<td>11</td>
<td>5</td>
<td>16</td>
</tr>
<tr>
<td>Printed documents</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2 descriptive statistical analysis (Raby, 2003)

But it seemed that what differentiated students' strategies was the way they regulated their activity. In consequence we processed the observation grids into navigation charts which enabled us to identify the selection of media and the student's instrumental behaviors in a dynamic way.

Figure 5 The navigation chart: changes and durations of instrumental behaviors during one working session (Raby, 2003).
Navigation charts allow us to represent in a single graph rhythmical and temporal data. These variables are very important if we want to analyze the different ways in which students regulate their task. On axis Y, one finds the duration of behaviors and on axis X, changes of behaviors. The blue arrows indicate the nature and duration of the different behaviors while the dotted lines indicate the learner's moves. These charts are analyzed in two ways: variability among and inside learners and task/activity discrepancies. It is, in fact, the study of those charts that convinced me, in the first place, of the interest of the concept of task redefinition. On one occasion, we were comparing charts representing the different behaviors displayed by six students observed during six different sessions, each time doing self-regulated comprehension work. We compared the six charts, for the same student, and could not make sense of their differences: it seemed that he was displaying very different strategies as he was behaving differently, although the task remained the same. Those differences were not due to differences in the choice of the media (an audio tape versus a film on TV), or to the prescribed task: written versus oral comprehension. It is by looking at the notes jotted down by the same students during the same working sessions that the differences could be explained. In those notes the student was saying more or less explicitly how he was redefining his task: sometimes, he was rehearsing for his coming examination, and in such cases he would time himself, he would not take a break, would not take notes and just note down his score; in other cases, he would decide to take the opportunity of the comprehension work to actually learn some English, in which cases he did fewer exercises, took a lot of linguistic notes and asked for some help.

Teaching situations
Raby and Borges (2001) have compared a traditional teaching situation and an innovative teaching situation. This investigation dealt with the way in which six language teachers changed roles (or not) when they switched from a traditional language class\(^2\) to the guided autonomy class\(^3\) in which the teacher was expected to act as a tutor. First, we specified the traits of the first training situation to elaborate a model to which we compared the innovative work situation. These traits were: the different instrumental behaviors and the nature of the verbal interactions between teachers and students and among students.

This modeling of the two situations led to an account of the teachers' appropriation of the new setting and the new forms of work. Results showed the relevance of the concept of instrumental genesis since one teacher dramatically changed his teaching behaviors; another did not change at all, and the four remaining ones seemed to hesitate between the two roles: that of instructor and that of tutor. We also found a relation between the level of computer literacy and the willingness to turn to a tutoring role. Finally, a comparison of teachers/learners interactions revealed that their content was 90% of the time language focused in the traditional class, whereas they fell down to 56% language focused in the guided autonomy class. In the mean time, interactions focused on technical matters occupied 3.4% of the time in the traditional class and 19% in the guided autonomy class.

**Traces of the subjects' activity**

We have already mentioned one kind of notes, those written down by learners during the working process such as they appear in figure 5, p.17. Other traces may be left by the students in

---

\(^2\) One teacher, 22 pupils sitting at their desk, one TV set, one TV recorder, and one overhead projector.

\(^3\) The same teacher, the same 22 students; 15 pc and 10 TV sets for the 22 students working on their own.
the form of drafts, screen captures. Screen captures, for instance, make it possible to retrieve the different screen pages accessed by a student while working on the computer and this contributes to a better understanding of how students have regulated their task (Raby and Penilla, in preparation).

**Productions (or performances)**

Productions consist of the written and oral productions of the learners: essays, exercises, dialogues, etc. They are one visible concrete expression of how much learners have acquired during a work sequence and they can be analyzed from different viewpoints (cognitive or linguistic traits, for instance, or motivational features…).

**Questionnaires, journals and interviews**

The great bulk of recent studies in work analysis concur in saying that the way in which learners or teachers redefine their task, not only its external goal and constraints but also its personal or social goals, its relevance and expected difficulty, weighs a lot on the mental processes in progress (Almaberti, 1991; Almaberti & Hoc, 1998; Chambers and Davies, 2001; Levy, 1997; Chapelle, 2001). Therefore, we need to build up a third sort of data pertaining to the actors' conative (motivational) and affective characteristics. To extract the actors' representations of their work, before and after their activity, we either rely on questionnaires, such as the ones broadly used to study language learning strategies (O'Malley & Chamot, 1990) or motivation (Dornyei, 2000, 2001, 2003). They give us a preliminary view of the issue at stake and put us on the track of further relevant investigations.
We use questionnaires to extract two different kinds of information: on the one hand we try to know how students or teachers have redefined their task; on the other hand we try to know how they feel about the achieved task. For instance, in the case of learners, we use pro-active questionnaires which are passed just after students have received instructions and just before they set out to work. They are very short and look like this:

- What do you have to do or are you going to do now?
- What instruments can you use to do this task?
- What constraints do you have? (length of your production and time available)

Then, we use retro-active questionnaires, completed just after they have finished with their work, to see how learners evaluate their activity. We analyze them in the light of attribution theory (Weiner, 1980). Attribution theory assumes that all individuals use a number of ascriptions to explain what has happened to them and to interpret past events: "I failed because I did not read the instructions carefully" and to predict the results of achievement-related events: "Therefore, next time I will be more careful and I will succeed." Usually, questionnaires are processed quantitatively. They often lead to some questions which require qualitative investigations, in the form of semi-structured interviews. Recently, we have started using an approach based on the combination of two theories: discourse analysis and social cognitive psychology (Ghiglione et al, 1998). This team have developed a computer application: Trope, which carries out an automated analysis of discourses. Thanks to Tropes, we are able to extract implicit messages that would have escaped us if we had analyzed interviews or journals in an ad hoc manner; besides, it allows systematic comparisons of different discourses.

---

4 For more information, see Acetic's home page.
Figure 6: Tropes interface: a semantic and syntactic process

This figure shows an extract from a pre-service teacher’s journal found on the Internet (Haley, n.d.).

In the upper right box, the text that is being analyzed has been broken down into phrases. The words in red correspond to the linguistic categories examined in the left box. The menu, in the upper left box, describes the different categories which can be analyzed (semantic and syntactic). The graph in the lower box, on the right, represents the proximities between two linguistic categories in the passage that is being analyzed and which can be seen above. This is a very

---

5 http://gse.gmu.edu/research/mirs/journals.html
useful technique to analyze and compare students' or teachers' interviews or journals (Raby, in preparation & Raby et al, in preparation).

Data cross checking

Assuming researchers have been able to gather all the different data mentioned in our method, they might find themselves faced with two difficulties. The first one lies in the very different nature of the data: you cannot add behaviors to representations; the second difficulty lies in the fact that often the different data do not corroborate (and sometimes clearly contradict) one another. In one survey, we had interviewed learners just after the realization of their communicative task (a chat on the web); some learners were quite happy with their work although they had hardly engaged in a real communication in the foreign language, while others were very critical of their productions whereas they had, in fact, done quite well from the teacher's point of view, considering the difficulty of the task. In such situations a theory is needed to make sense of the discrepancy or opposition between performances, behaviors and beliefs. Often, in fact, several theories are needed because learning or teaching seen not only as performances but also as psychological and social processes, call for dimensions to be taken into account.
Future Directions

For the following years, our investigations will be focused on the Internet and its different and manifold potentialities for language learning. We have launched an interdisciplinary research program on this subject which brings together researchers from SLA, cognitive psychology, educational sciences and from instructional design. We are now implementing a large scale experimentation during which we will compare collaborative scenarios to individual scenarios and working with papers versus working with the Internet. We will be able to see things from the teacher's side and the learner's side, taking into account their interactions. The "riddle" which inspires this research is: is there something actually motivating in the Internet which distinguishes it from other means of information, and if so what is it exactly?

6 ESCALE is the name of the project (Evaluation of Collaborative Scenarios for Language Learning ). It is supported by the CNRS (The French official research body) and gathers researchers from MTAH (Models & Techniques for language learning), an interdisciplinary and international group of 50 researchers involved in instructional system designs.
Issues

One theme is becoming very popular in CALL research: distant learning. It is becoming popular because through distant learning it is the ability of future citizens to build up the "global village" which it is at stake. We are interested in this question as researchers because it concerns us as "citizens of the world". What part will the Internet and networked teaching play in this worldwide political context? Will the gap between little equipped developing country and highly equipped developing countries become aggravated by an increasing "information" gap.

A number of studies and results are available on these subjects predominantly dealing with questions such as the teacher's new role, students' motivation or attrition, the potential usages of the learning system (Salaberry, R. 2000). Some studies describe the new interactions among learners or teachers and learners through the chat (Chapelle, 1997 & 2000; Chun, 1994; Kern, 1995; Pelletieri, 2000; Smith, 2003). Other investigations are focused on the nature of language acquisition such as vocabulary or language competence (Sotillo, 2000; Gastaldi 2002) but few of them are focused on the actual efficiency of distant learning as general learning models, taking into account both performances and processes (Warschauer & Kern, Eds., 2000, Sampson, 2003). Here again, we need a theory about CALL which would help researchers to integrate such an accumulation of empirical data.

Conclusion

In 1997, Carole Chapelle wrote: "A glance through the computer-assisted language learning (CALL) literature of the 1990s reveals the profession's quest for principled means of designing and evaluating CALL. Like researchers in other facets of applied linguistics, CALL researchers look to cross-disciplinary sources for perspectives and research methods." (Chapelle, 1997, p.19). She also claimed that CALL research was in search of a new paradigm.

14/12/2003 18:59
We hope to have suggested that educational ergonomics could contribute to the building up of this new paradigm for different reasons. First, because it provides scientific knowledge about the non-linguistic factors of language acquisition; secondly, it sees CALL contexts as cultural and social contexts, not just linguistic and technical ones. Finally, it offers a method which is likely to integrate different data, qualitative and quantitative, linguistic and non-linguistic. Moreover, educational ergonomics seeks to provide a theory of the instrument which does not separate CALL phenomena from language learning and teaching phenomena in general; instead, it seeks to put CALL systems in their right instrumental place, in the noblest sense of the term (Noble, 1998; Baillé & Raby, 1999).

Références bibliographiques


Frascara (Jorge). Creating communicational spaces.


