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A computer assisted method to track listening strategies in second language learning

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Abstract

Many studies about listening strategies are based on what learners report while listening to an oral message in the second language (Vandergrift, 2003; Graham, 2006). By recording a video of the computer screen while L2 learners (L1 French) were listening to an MP3-track in German, this study uses a novel approach and recent developments in computer technology to examine objectively what learners do while listening. The videos of the participants' screens show the movements of the mouse and its time-course, and therefore the pauses and the backward or forward movements learners do in order to master their listening task. In this study, "self-regulation" indicates the capacity of the listener to exercise physical control over the listening input by using the mouse. Our point is that the recorded physical movements of the mouse during the listening task are a good indicator of metacognitive activity. This is independent of what the learner reports. The data and the time-courses of the mouse were then analyzed, from both a psycholinguistic and a linguistic point of view. This enabled us, on the one hand, to define a typology of listening strategies depending on the initial level of the participants and to show that, on the whole, the opportunity to have personal control over information input/intake does improve all the learners' information processing. On the other hand, tracking the movements of the mouse while a learner individually listens to an oral text on a computer also has a methodological interest and equally allowed us to verify some precise research hypotheses about the links between linguistic features, for example, place of German compounds and final position of the verb in a subordinate clause, self-regulation strategies and comprehension.

Keywords: Listening strategy, CALL, aural comprehension, metacognitive strategy, self-regulation

1 Introduction

Listening comprehension lies at the heart of language learning, but it is the least understood and least researched skill (Vandergrift, 2007). That is why particular attention must be paid to aural and auditory comprehension as a necessary skill in foreign language acquisition and in particular to the part played by listening ability. While reading a text, L2 learners as well as L1 experts can easily stop and go back to poorly understood pieces of information**.** While listening, it is not possible to develop such strategies because of the continuous incoming speech-flow. They cannot go backwards or simply stop in order to listen again if they want to think about the meaning of what they have already heard. Due to the linearity of oral speech, they

gradually discover structural information which is not immediately available because of the transient characteristics of oral discourse. Reading theories cannot be applied straightforwardly to aural listening and understanding, particularly as far as the receiver's control over incoming information is concerned (Roussel *et al.*, 2008). Nowadays CALL seems to give learners and listeners the flexibility they need to better deal with oral messages. O'Bryan and Hegelheimer (2007) attempt to integrate CALL activities in the form of podcasts into an academic English as a Second Language (ESL) course and describe its effect on listening strategies. These authors see many advantages in providing the students with MP3-tracks in the foreign language. They suggest with Thorne and Payne (2005) that podcasts can be used to provide learners with samples of real speech and other authentic materials. Stanley (2006) suggests that podcasts could be used as a supplement to textbook materials and as a way for students to gain information on specific aspects of the language such as idiomatic expressions or grammatical constructions. We see another important interest in listening to an MP3-track that could be a podcast in a foreign language and, in particular for the present study, in German, on a computer or on an MP3-player. This offers a relevant individual alternative to "collective listening" in the classroom and is indeed of important methodological interest for the study of listening "intake" strategies. While listening to an oral message, L2 learners as well as L1 experts, provided they use an MP3-player device, may nowadays regulate and freely control the information input/intake.

In the current study, several experiments were carried out in which L2 learners (L1 French) were expected to listen to an MP3-track in German on a computer while software for screen recording (Camstudio) was used to automatically record the movements of the mouse and its time-course "on-line". The movements of the mouse indicate three possible choices: make a pause in the listening task, go backward to listen again and go forward. This new method enabled us to make an accurate analysis of the subjects' self-regulated listening strategies in information input/intake. We think that movements to stop, go backwards or forwards with the mouse during the listening task are indicative of metacognitive activity by the learners, such as planning and monitoring.

The first purpose of our study is to measure whether personal control over information input/intake improves information processing for all learners and in what way different strategies used by the learners depend on their initial expertise. Recording the movements of the mouse online while learners were listening to an MP3-track on a computer enabled us to show that their choice of one or the other strategy influenced their performance in comprehension, and finally that some linguistic difficulties influence their strategies and their performance in comprehension. In this paper, both group quantitative measures and presentation of examples from individual subjects will be reported on. We will present students' score averages in comprehension, using different strategies, as well as examples of individual students' listening strategies.

2 Listening strategies in CALL

Five issues need to be examined on a theoretical level: (1) the place of cognitive and metacognitive strategy use in the listening process; (2) the interaction between

learners' proficiency level in the target language and the strategies used; (3) CALL and listening comprehension; (4) the impact on listening comprehension after allowing learners to control aural input delivered by a computer; (5) different methods used to track listener strategies.

2.1 The place of cognitive and metacognitive strategy use in L2 learning in the listening process

In light of cognitive theory, O'Malley and Chamot (1990) distinguish between two major types of learning strategies: metacognitive strategies and cognitive strategies. Metacognitive strategies such as planning, monitoring, or evaluating consist of using cognitive processes. Cognitive processes and strategies mean the steps or operations employed in solving problems that need direct analysis, transformation or synthesis of incoming speech information and involve direct manipulation of the language. In metacognition, there is a dimension related to awareness and to conscious choices of efficient strategies. Wenden (1987) considers that metacognition includes metacognitive knowledge and regulatory skills. In Anderson's (1995) three-phase model of perceptual processing parsing and utilization, listeners reported the following difficulties: (1) not recognizing words; (2) neglecting what follows; (3) not chunking the stream of speech; (4) missing the beginning of the text, and (5) concentration problems. Although Anderson's three-phase model is based on first language comprehension, Goh (2000) recognizes the relevance of this model for L2 comprehension. Field (1998) describes strategies as "strictly compensatory" for the listener's imperfect knowledge of L2 syntax and vocabulary. The current study will explore whether learners can compensate for unknown words by using self-regulatory strategies on a computer; that is to say that they will come back more often to listen to difficult words, or stop to have more time to think about the meaning of what they are listening to. What we call self-regulation indicates the capacity of the listener to exercise physical control over the listening input by using the mouse. Consequently "physical" self-regulation needs to be distinguished from metacognitive knowledge, that is, the ability of learners to plan and regulate their listening. The point is that the recorded physical movements of the mouse during the listening task are a good indicator of metacognitive activity. For example, in the case of the metacognitive strategy of selective attention, "where a listener decides in advance which aspect or part of the input to pay attention to" (Goh, 1998), the movements of the mouse during the listening task can be considered as a surface marker of this kind of decision.

2.2 The interaction between learners' proficiency level in the target language and the strategies used

Listeners' prior knowledge and language proficiency, for example, are two factors frequently considered by researchers (Chiang & Dunkel, 1992). These two factors interact together to affect listening comprehension. Recent investigations of the differences between higher-skilled and lesser-skilled L2 listeners provide greater insights into the ways in which listeners regulate these processes (Vandergrift, 2007). The importance of metacognitive strategies in L2 listening success is highlighted by

these studies (O'Malley & Chamot, 1990; Goh, 2002b; Vandergrift, 2003; Chamot, 2005). In a study of adolescent French learners, Vandergrift (2003) found statistically significant differences in strategy use: skilled listeners reported using about twice as many metacognitive strategies as their lesser-skilled counterparts. Through the use of these strategies, learners become more engaged in the comprehension process and thus try to control it. They become aware of their way of understanding by storing information and taking steps to manage and regulate the process. The use of such regulating strategies seems to improve the listener's performance in oral comprehension; however, the degree to which it does so may be contingent upon the level of language proficiency. In the present study we therefore first measure the initial level of listening comprehension in the second language to be able to relate listeners' proficiency, strategy use and performance in comprehension.

2.3 CALL and listening comprehension

A number of research studies have proved that with the use of a computer and Web technology, listening comprehension can be taught much more efficiently and effectively. For example, a research study conducted by Brett (1997) investigates the effectiveness of computer-based multimedia applications for developing listening skills. It shows that multimedia enhances listening comprehension greatly. In a similar study, Klassen and Milton (1999) demonstrate that CALL can be an efficient medium whereby learners can improve their listening skills significantly. Smidt and Hegelheimer (2004), in a study examining how Web-based video assists listening comprehension, conclude that online academic lectures supported by multimedia increase listening comprehension. A significant feature of integrative CALL is a shift from language-learning software and CD-ROMs to Web-based activities that allow learners flexible, self-paced access to information (Fotos & Browne, 2004). The Web-based practice tools also create different learning and assessment contexts, and produce flexible approaches to instruction and evaluation (Lee, 2007). Flexibility, autonomy and repetition are often mentioned as the advantages of learning with CALL, but the question here concerns the possibility of measuring their impact on listening comprehension and to analyze the way in which students control their listening tasks.

2.4 The impact on listening comprehension of allowing learners to control aural input delivered by a computer

As mentioned in the introduction, computers and CALL environments allow learners to control and master the way they listen to oral speech in a second language. Previous studies have explored this. Using a novel approach and recent developments in computer technology, Zhao's study (1997) examined the issue of speech rate and listening comprehension. In his study, Zhao gave the control of speech rate to students, so that in condition 2 of his experimentation, the subjects had the opportunity to select the speech rate they desired before they listened. In condition 3, the subjects could change the speech rate while listening to a passage by clicking on the 'Faster' or 'Slower' button. Zhao concluded that when given control, students' listening comprehension improved. Subjects could understand better when they had

control of speech rate. In our study, the participants could not control the speech rate but they could stop, go back or forward and listen again, so that they had *some* control of the speech too. We investigated whether this method of control could also have an effect on listening comprehension.

2.5 Different methods used to track listening strategies

To study learner metacognitive knowledge about listening, various procedures have been used, most commonly diaries (Goh, 1997), interviews (Goh, 2002a), and questionnaires (Goh, 2002b; Vandergrift, 2002, 2005). Researchers have also used introspection, think-aloud in particular, to study how L2 learners use metacognitive strategies to deal with difficulties and facilitate their comprehension (Bacon, 1992; Goh, 1998; Mareschal, 2002; O'Malley & Chamot, 1990; Vandergrift, 1997, 2003). In these studies, listeners are asked to 'think-aloud' as they listen to an oral text, reporting on what they are attempting to do as they try to understand the text. Given the limitations, however, of any one of the research methods mentioned above, it is important to use different tools in order to triangulate data. In the current experiments we used multimedia to examine listener strategy use. Recording online movements of the mouse while L2 learners listened to an MP3-track in German on a computer offered an alternative to learners' reports of what they do during the listening task. It allowed the observation of information input and objective self-regulation to collect data, which seemed to be complementary to the previously mentioned studies.

3 The study

The study consisted of four experiments. Experiments 1, 2 and 3 tested the effects on comprehension of (a) listening conditions, (b) initial level of learners' competence, and (c) listening strategies. Experiment 4 tested the influence of particular language difficulties in German on comprehension and strategies. These four experiments also examine the interaction between these different factors, not only the effect of each factor on comprehension but also whether the initial level had an impact on the choice of strategy, and whether some listening conditions are more effective for learners with a certain competence.

3.1 Experiment 1

In the first experiment, thirty foreign language students aged between 14 and 16, level B1/B2 (CEFR, 2001) were divided into three groups after an initial test, which consisted of listening twice to an aural speech in the classroom (the learners in group A obtained the best score in recalling the speech, group B an average score, and group C a poor score). The participants listened to aural discourses in German once or twice – under teacher supervision – or individually, freely controlling the listening input on a computer. While they listened on the computer, we used a screen recorder to track their movements backwards or forwards, as well as the pauses. In all conditions, after listening, they had to make a written recall of all they had understood from the speech they had heard, in their mother tongue (French). We made a propositional analysis (Kintsch, 1998: 37) of all the written recalls to measure their

Table 1 *Protocol of the first experiment*

	Speech 1/121 propositions/681 words	Speech 2/91 propositions/481 words	Speech 3 63 propositions/445 words
Groupe A	Listening once	Self-regulated	Listening twice
Groupe B	Listening twice	Listening once	Self-regulated
Groupe C	Self-regulated	Listening twice	Listening once

Table 2 *Protocol of the second experiment*

Group 1	Listening twice
Group 2	Self-regulated

performance in comprehension, counting the number of propositions of the speech which were recalled by the participant after listening to the text. Two raters independently evaluated all the recalls of the participants. If, in their recall, the participants remembered the general structure of the speech, i.e., the links of cause and effect or the consequences between the propositions, then the evaluators included this. The evaluators not only counted the propositions recalled, but they also took note of those participants who recalled the links between the propositions. The raters gave one point for one recalled proposition and also evaluated recall of the macrostructure of the text. They then calculated each learner's score as a percentage. In this first experiment there were, therefore, three level-groups, three speeches and three listening conditions, as presented in Table 1.

3.2 Experiment 2

Due to the fact that, in the first experiment, the discourses were too varied for us to truly identify the separate parts of the different factors (initial level and listening condition) which influence comprehension and listening strategies, we carried out a second experiment. In this second experiment, 29 participants[1] were divided into two groups. Each group had the same average level. The first group listened to a discourse twice and the second group to the same discourse on a computer, as presented in Table 2.

3.3 Experiment 3

In order to obtain more occurrences or samples of strategies in the condition of self-regulated listening, we carried out a third experiment asking all our 29 participants

[1] In experiment 1, there were 30 students from one class. In the middle of the school year, one of these students halted her studies and therefore did not participate in the second and third experiments. The fourth experiment was carried out with students from another class, whose initial level was evaluated with the same initial test as the students of experiments 1, 2 and 3.

Table 3 *Protocol of the third experiment*

Self-regulated listening to the same text by all the participants
A Good initial level in oral comprehension
B Average initial level in oral comprehension
C Poor initial level in oral comprehension

Table 4 *Protocol of the fourth experiment*

Speech 1: compounds in non salient position	Speech 2: compounds in salient position
Self-regulated listening by 20 participants	Self-regulated listening by the 20 others participants

to listen to the same discourse on a computer. We wanted to compare the listening strategies used by learners of different initial levels in more detail. We compared those who listened to the same text and monitored the effect on comprehension, as presented in Table 3.

3.4 Experiment 4

In experiment 4, we tested the effect of the position of difficult compounds on comprehension and self-regulated listening strategies (see Table 4). After pre-testing, 40 students were divided into two groups with the same average level. Each participant listened to one of two speeches on a computer (self-regulated listening). In the first discourse, difficult German compounds were in a non-salient position, so that the learners did not need to understand each difficult compound to understand the global meaning of the discourse and to develop the situation model (Kintsch & Van Dijk, 1978; Kintsch, 1998). On the contrary, in the second discourse, the same compounds were in a salient position so that the learner had to understand them to develop a correct situation model. We predicted that while listening to the first discourse the learners would first listen globally and not stop on the compounds. Conversely, we thought that if they were listening to the second discourse – in which the compounds were crucial to understanding – they would stop and go back on the difficult compounds and so adapt their strategy to the discourse to facilitate understanding.

4 Findings

We said that in the *first experiment* we used three different speeches. As they were each a different length, contained a different number of propositions and the third speech seemed to be easier to understand for the learners than either of the others, it was not possible to compare the score values of the learners in comprehension. For this reason, we calculated a z-score so that for each speech the average score of all the learners was 0 and the standard deviation was 1. The z-score allows us to compare the modified scores in comprehension and consequently to neutralize the

Table 5 *Recalled propositions (Z-score) for each group and each listening condition*

	Pre-test	Speech 1	Speech 2	Speech 3
Group A 10 learners		Imposed listening once	Self-regulated listening on a computer	Imposed listening twice
	25,6	0.78	0.99	0.76
Group B 10 learners		Imposed listening twice	Imposed listening once	Self-regulated listening on a computer
	14	−0.55	−0.51	0.29
Group C 10 learners		Self-regulated listening on a computer	Imposed listening twice	Imposed listening once
	7	−0.23	−0.48	−1.06

"easiness" effect of the third speech. As expected, there was an interaction between the effect of the initial level of the learner and the effect of listening conditions on the performance in comprehension. This was proved to be correct when learners were listening once ($F(2.29) = 22.7$; $p < 0.01$), twice ($F(2.29) = 12.6$; $p < 0.01$) or on a computer under self-regulating conditions ($F(2.29) = 4.47$) ; $p < 0.02$). There was a simple effect of listening conditions on performance in comprehension: self-regulated listening enabled the main body of participants to obtain better scores than when listening once ($t(29) = -4.45$; $p < 0.01$) or twice ($t(29) = -3.16$; $p < 0.01$). There were no significant differences between listening once or twice. The learners' initial levels play a major part in the performance in comprehension whatever the listening conditions are. The better group of learners obtained the best score in comprehension in all of the listening conditions (see Table 5).

In the *second experiment*, learners were divided into two groups, as previously described.

The average score of the first group is 21.5% and that of group 2 12.5% (see Table 6). The students' t-test shows that the difference is not significant ($p \approx 0.09$). This may be due to the fact that there a huge variance in the participants' scores in comprehension in each group. The second experiment confirmed the results of the first one. We concluded that self regulation did not enable a learner with a poor initial level to obtain a better score in comprehension than a good learner, who listened to the discourse only once.

In the *third experiment* we used the same level-groups as in the first experiment but all the learners listened to the same speech on a computer (see Table 7).

The average score is 37%. This is a good performance. The scores are between 7.5% and 92.6%. The initial level kept playing a key role in the comprehension performance: a t-test showed that the difference between group A and B was significant ($p < 0.02$) like the one between A and C ($p < 0.01$), while there was no significant gap between B and C ($p \approx 0.1$). Some learners in groups B and C had nearly as good a score as learners in group A. We will now study the type of strategies used by the learners.

Table 6 *Average score in recalling the speech in percentage (and standard deviation) for each listening condition and depending on the initial level*

Group	Listening conditions	Average score in comprehension depending on the initial level (A good, B, average, C poor)	Average score in comprehension
1 (n = 14)	Self-regulated listening	A 28,7%	21.5 (9.22)
		B 18,8%	
		C 17%	
2 (n = 15)	Imposed listening twice	A 24%	12.5 (9.36)
		B 8,3%	
		C 5,2%	

Table 7 *Average percentage of recalled propositions and standard deviation for each initial level in the self-regulation condition*

Groups	Average score in comprehension
Group A (n = 10)	54% (29)
Group B (n = 10)	29% (13)
Group C (n = 9)	22% (13)

4.1 Learner strategies

As described in section 3, we completed the evaluation of the participants' French recall with an analysis of the on-screen-recordings of their time-codes while listening to the speeches in the form of MP3- tracks in German on a computer throughout all three experiments. This analysis allowed us to represent student listening behavior and time on task on a graph, with time on task in seconds on the x-axis and length of the oral text in seconds on the y-axis. The research team determined that listening behavior could be summarized by four different patterns of self-regulation (see Figures 1, 2, 3 and 4), which involved various patterns of uninterrupted and interrupted (or analytical) listening. Graphic representations of the four approaches to resolving comprehension are illustrated in Figures 1–4.

Generally speaking, the first type of strategy gave the best results, particularly for learners with a good initial level. They firstly listened to the discourse globally and then split it into chunks of meaning to clarify what they had already understood, thus showing planning and monitoring ability. In each group of learners, the standard deviance and the differences between them were clear. The second type of strategy, an analytical listening exercise followed by one or more global listening exercises, resulted in some inferiorities in comprehension results. A lot of learners in group B used this strategy. The third type of strategy was used by two categories of learners: those who were really good at comprehension, or, in some cases, bilingual.

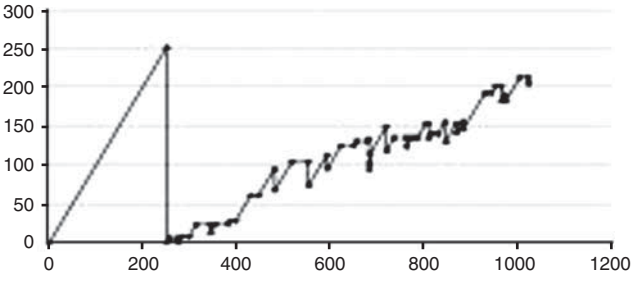

Fig. 1. Type 1: one uninterrupted global listening followed by one analytical listening

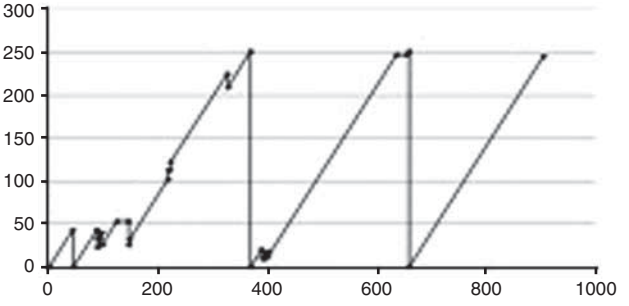

Fig. 2. Type 2: one analytical listening followed by one or several global listenings

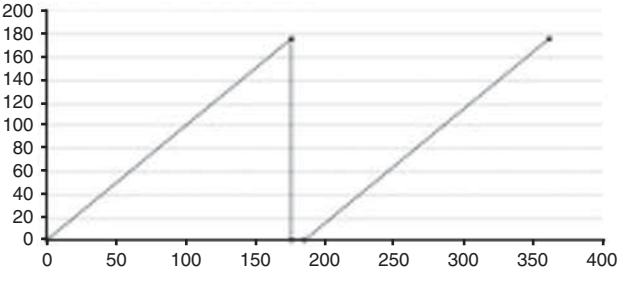

Fig. 3. Type 3: one or several global listenings without any regulation

They understood the meaning of the speech immediately and did not need to stop or go backwards. However, this third type of strategy was also used by learners who had a lot of difficulties. We suggest that, for this kind of learner, it was too difficult to parse the speech or to recognize chunks of discourse, which would have allowed them to know where to stop or go back. We also suggest that self-regulation represented too heavy a cognitive load for them. The fourth type of strategy was used by learners with a poor initial level, who were trying to regulate their listening task. Movements to pause, go backwards or forwards were numerous and disorganized. Their low-level listening processes such as segmentation or perception were not sufficiently automatic to release enough cognitive energy and enable them to use high-level processes such as planning or monitoring. Those results confirm

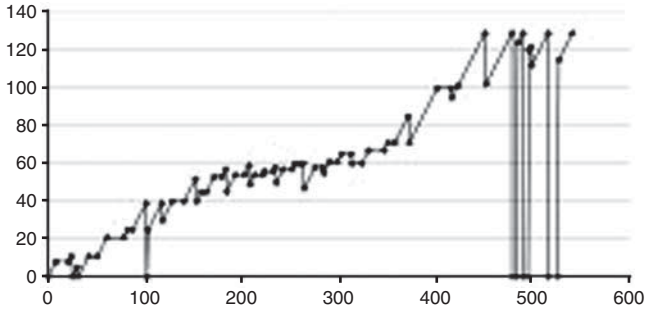

Fig. 4. Type 4: only one analytical listening without any global listening

and illustrate the difference that Vandergrift (2003) describes between high-skilled listeners and their lesser-skilled counterparts.

In the *fourth experiment* forty participants, who were French high school students aged 15–16 years old with German as an L2, were divided into two groups with the same average score in the initial listening test. Participants had all been learning German for five years. They were considered as "independent users" (CEFR, 2001: 25) and their language level corresponded to B1 (CEFR, 2001). Their initial level before the experiments had been established by a test consisting of listening to a speech sample twice and recalling in French (L1) what they had understood. Recall had been assessed following a propositional analysis. We selected six German compounds „*Der Unternehmensberater, Das Wirtschaftsleben, Die Betriebsleiterin, zahlungsunfähig, Das Beruhigungsmittel, Der Wohnzimmerboden*". For this experiment we did not want our participants to know the meaning of the target compound words, because we wanted them to work it out for themselves. We wanted them to make an effort to find out the meaning of the compounds because we believe that, if they have to make an effort to find the meaning, they will stop or rewind to listen to the word again if this word is very important to be able to understand the story. Thus, we made sure, through prior testing, that the selected words were unknown to forty pupils of the same age in other German classes at the same level. These students (from other German classes) heard ten words including our six difficult compound words and they were asked to say, in French, what they meant.

Then we created two narrative speeches containing the six compounds which were recorded by a German native speaker: in the first speech, compounds were in a non-salient position – indicating that they were unnecessary for the learners to grasp the global meaning of the text; in the second version, the same six structurally complex compounds were in a salient position – all of them being, this time, semantically crucial. Twenty students listened to the first speech and twenty others to the second speech on a computer. They all had the possibility of regulating their listening task.

After listening, the participants had to recall the speech in French in writing, as in the previous experiments. However, we added other ways to measure listening comprehension, adapting the Kintsch *et al.* (1990) method. We made a proportional analysis of the whole recall and another one only of the situation model. According to Kintsch, the situational model is the representation of the situation to which the text refers. The propositional representation consists of a list of propositions that

are derived from the text. In order to evaluate the comprehension of the text by the learners we counted (1) the number of propositions in the text which were recalled and (2) the number of recalled propositions which corresponded to the situation model. We also looked at the recalled compounds and analyzed the way they were recalled. The participants then had to answer six questions on the target words, listen to a list of ten words containing the target words and say whether they recognized each word as being used in the speech.
We wanted to test the following general hypotheses:

(i) Influence of the initial level on the selected strategy: we predicted that the more skilled listener would stop on difficult words, and lesser-skilled listeners would not.
(ii) Influence of the selected strategy on comprehension: students who used a Type 1 strategy would stop on the compounds and point them out correctly. Students who selected a Type 2 strategy would also stop on the difficult words but would not point them out correctly. Students with Type 3 strategies would not stop on the words and would not point them out correctly.
(iii) Influence of the initial level on comprehension: more skilled listeners would recall compounds exactly, less skilled listeners would use paraphrases, equivalent expressions or nonsense.

We also wanted to test particular hypotheses for our two speeches:

(i) While listening to the first speech, where compounds were in a non-salient position, we predicted that the students would use more Type 1 strategies, listening more globally, because they would not be disturbed by the difficulties.
(ii) While listening to the second speech, where the same compounds were in a salient position, we predicted that the students would select Type 2 strategies, stopping quickly on difficult words because they were very much disturbed by them in understanding their global meaning.

We found that the initial level of the students (score from the initial test) correlated significantly with all the dependent variables:

- the written recall of either speech one or speech two: ($r = 0.74$; $p < 0.01$). The better the students scored in the initial test, the better they recalled the speech they had listened to.
- the recall of the situation model ($r = 0.632$; $p < 0.01$)
- the number of recalled compounds ($r = 0.739$; $p < 0.01$)
- the score on the questions ($r = 0.569$; $p < 0.01$)
- the score in recognition ($r = 0.492$; $p < 0.01$)

The text had an effect on the recall of the situation model ($F = 4.97$; $p < 0.032$): the text with the difficult words in a salient position resulted in a worse recall of the situation model. However, it had no effect on the other dependent variables. There was no simple effect of the type of text (compounds in a salient position or not) on the strategies. But we noticed that there was a relation between the number of movements (backward and forward, and pauses) and comprehension. For speech 1

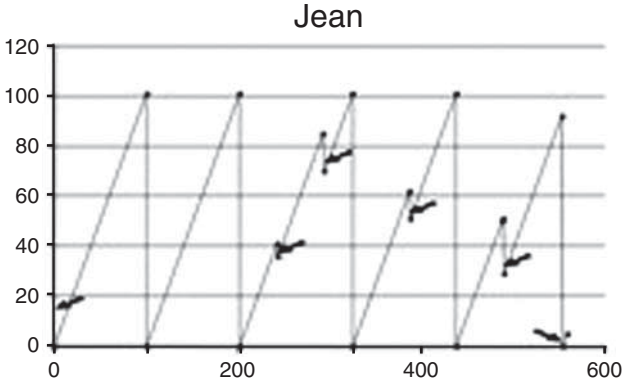

Fig. 5. Example of the listening strategy used by Jean

(difficult words in a non-salient position), the more movements there were, the worse the recall of the speech was ($r = -0.36$) and the worse the recall of the situation model is ($r = -0.21$). For the second speech, the more movements there were, the better the recall ($r = 0.28$). There was no correlation with the situation model ($r = 0.06$). This means that while listening to the second speech, students who went backwards or stopped more often on difficult words had a better comprehension result.

Two cases illustrate these results. Jean[2] and Marion were two students who had heard the first speech, with the difficult words in a non-salient position. Jean was a high-skilled listener (initial test score 14%) Marion was an average-skilled listener (initial test score 8.5%). They had selected the same type of strategy (Type 1) which, with regard to our hypothesis, seemed to be an adapted strategy for listening to the first speech. However, there were interesting differences between the two Type 1 strategies they used. Although they both first listened globally to the text, Jean went back and stopped on the compounds, listening five times, whilst Marion did so only once, but not on the compounds. In the graphics shown in Figure 5 the arrows indicate the positioning of the six target compounds.

Jean used strategy 1, listening first to the text globally, then going back exclusively on the target words. His score in the recall is 78% (average = 28%), in the situation model 9 (average = 4.70), in the questions 4.25 (average = 1.51), and he recalled 4 target words exactly (average = 0.68).

Marion had selected strategy 1 too, although it looks much more like strategy 3 (see Figure 6): there were almost no movements of the mouse and she did not stop on the difficult words at all. This was because the compounds did not hamper her comprehension of the global meaning. Her score in the written recall is 60% (average = 28), which means she had understood the global meaning of the text. In the situation model she scored 8 (average = 4.70), for the questionnaire 2.75 (average = 1.51), but she recalled only one target word (average = 0.68).

This example shows that Marion and Jean selected and adapted a strategy for the first speech. Marion's strategy allowed her to understand the global meaning of the

[2] The first names were changed.

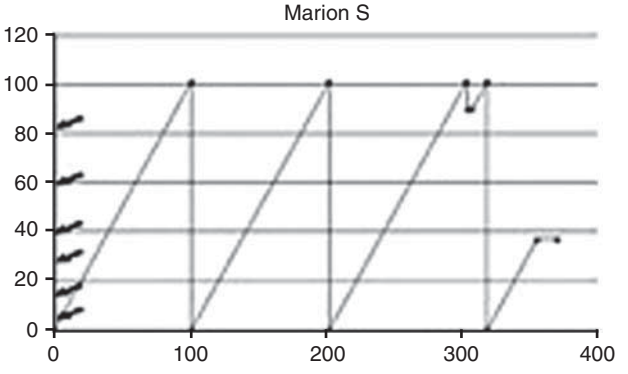

Fig. 6. Example of the listening strategy used by Marion

text well enough. She was not disturbed by the compounds, the meanings of which were, in fact, not essential for understanding. Marion's strategy enabled her to understand the speech. Jean, as a high-skilled listener, did a little more than necessary. He understood very well. He identified the difficulties and decided to stop exactly on the target words of the speech. Consequently, his comprehension of the text was deeper than Marion's; his score in the situation model was almost perfect (9/10) and he recalled more target words than she did.

With reference to Jean and Marion's situation models, in order to evaluate the global comprehension of the text, we completed the propositional analysis of the speech recall with an analysis of the recalled situation model. The scores in the situation models of these two students were almost identical: Jean 9/10, Marion 8/10. Difficult target compound words did not appear in the situation model of Jean and Marion because, as expected, difficulty in a non-salient position in the speech did not change the level of understanding of the general meaning of the text.

With reference to Jean and Marion's recall of target words, it was found that Jean recalled the first item, "Management consultant", with the French "*chef d'entreprise*", which does not mean precisely the same thing, but is close to the real meaning. Marion recalls it with "journalist", which is not the meaning, but she inferred the profession of the man from the context, because she understood that the man usually wrote articles for a newspaper. The second item, "Economic Life", is the name of the newspaper. Jean recalled it with "*l'économie*…"; he did not understand or catch the word "life". In her French recall, Marion identified the word "*Wirtschaftszeitung*" in German. The third word, "manager", is well recalled by the two students as "*chef d'entreprise*". Marion did not recall any of the last three target words, as opposed to Jean, who found an excellent equivalent expression in French, "*être sur la paille*", for the fourth word, "insolvent", which was probably the most difficult word to understand. For the fifth word, "sleeping pills", Jean gave a general expression in his recall, "*cachet pour qu'elle se calme*", which means "tablet/pill so that she calms down"; he did not use the exact French word but he recalled the meaning. The last expression, "the dining room floor", was recalled accurately as "*le sol de la salle à manger*". In Jean's recall a trace of all compounds appeared: four were recalled accurately, the other two were mentioned but not recalled accurately. Marion only recalled one word exactly; she used code

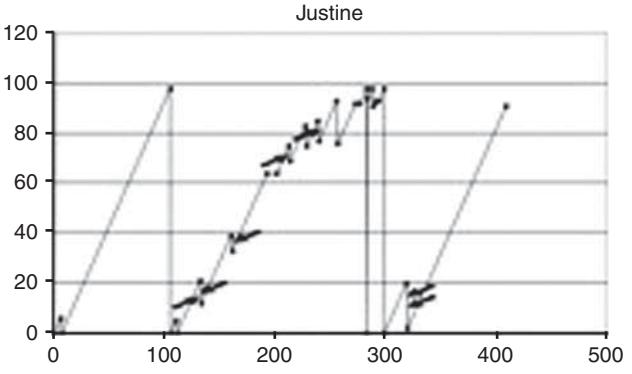

Fig. 7. Example of the listening strategy used by Justine

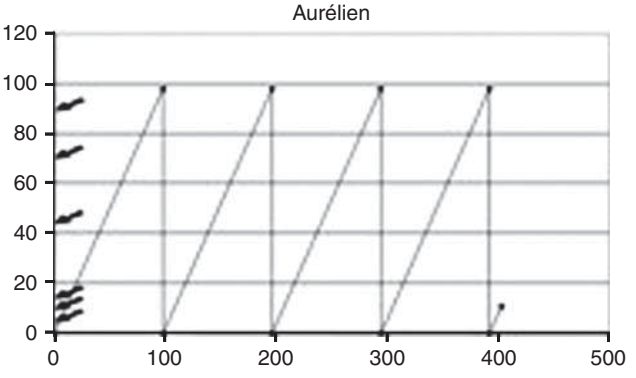

Fig. 8. Example of the listening strategy used by Aurélien

switching, writing what she heard phonetically or not giving any details at all. In conclusion, Marion's strategy was enough to understand the text globally, but Jean wanted to be more precise and used additional specific strategies.

Aurélien and Justine listened to speech 2, with the difficult words in a salient position. They were both high-skilled listeners, but Justine (score in the initial test 20.5%) was a little better than Aurélien (score in the initial test 17.7%). They selected different listening strategies. Justine (see Figure 7) selected a Type 1 strategy, with numerous movements; Aurélien (see Figure 8) selected a Type 3 strategy, and he listened to the speech globally, without going back or stopping at the difficulties.

Justine first listened to the text globally and then she went back and listened again many times. Her backward movements almost always pinpointed the target words and she concentrated her listening on the difficult compounds. As a high-skilled listener, she was able to identify what kept her from understanding, and to go back to listen again. Consequently she had a good score in recall, 59.4% (average = 24.45), and she scored 4/10 for the situation model, which is a good score in comparison to the other students who listened to the same speech (average = 2.55). We know that the position of the difficult words in the speech had an effect on the recall of the situation model

($F = 4.97$; $p < 0.032$): the text with the difficult words in a salient position resulted in a worse recall of the situation model. She could not recall one target word precisely, scoring zero points (average = 0.75). Her answers to the questions were not very precise because she did not understand the target words. She scores 1.5 points (average = 1.51).

Aurélien used strategy 3, listening to the speech only globally and not stopping or going back to difficult words (see Figure 8). His score for the recall of the text was poor: 9.9 (average = 24.45), and for the situation model 3 (average = 2.55). He recalled two target words (average = 0.75) – more than Justine. He also answered the questions better than Justine: 2.25 (average = 1.51). His recall of the speech and of the situation model was worse than Justine's.

For the situation model, Justine scored 4/10. She understood that a man needed help from a woman and that he had to meet some condition before she would give him her help, but she did not understand what the condition was. Justine wrote that the man was stressed and that he suddenly felt bad, so he wanted to call for help but he could not and died. It was not very accurate but Justine managed to maintain a kind of coherence in her situation model. Aurélien scored 3/10: he understood only three points in the situation model, those being that the man called a woman for help, that he took drugs and that he died. The recall was very poor. He did not identify the more difficult aspects and therefore the quality of his recall was substantially decreased.

With reference to Justine's and Aurélien's recall of target words, Justine and Aurélien did not understand the profession of the two characters, which is why they recalled them with a general term, "a man", "a woman"; their area of expertise of "economic life" was not recalled at all. Only Aurélien understood the idea that the consultant manager was insolvent; he wrote "*problèmes financiers*" (financial problems) and the global meaning of "sleeping pills", which he recalled as "drug". These two students were very confused by the difficult compounds. However, having chosen a strategy which was adapted to the difficulties of the speech, Justine dealt better with the listening task.

5 Conclusion

In our study, we resorted to a new method and to an experimental protocol. The aim of this was to identify accurately and to represent graphically listening ("intake") strategies used by L2 learners. This method allows us, for the first time, to directly and objectively access listening strategies and not only what the listeners say about these strategies. This method can confirm and complete the analysis of self-reported listening strategies. In addition, it allows us to identify precisely the parts of speech where listeners stop or which they want to listen to again or to skip. We can therefore make a hypothesis about the reasons why they do so and about the linguistic difficulty they have. On the whole, this study allows access into the way that listening strategies are organized and categorized, in order to build a hypothesis about the link between them and other student characteristics, while factoring in the type of speech (level of proficiency, linguistic features).

We found that, although the initial level does play an important part and influences L2 "input/intake" processing, self-regulation strategies allow learners to better

handle incoming aural discourse.We also noticed that L2 learners really need to be ''taught'' how to regulate such a listening task. We thus recommend that specific tuition is given in order to help L2 learners develop ''top-down'' compensatory and metacognitive strategies which are likely to improve their ability to extract meaning from the incoming information.

In order to assess the validity of the ''Metacognitive Awareness Listening Questionnaire'' (MALQ), Vandergrift *et al.* (2006) found that metacognitive knowledge could explain about thirteen percent of the variance in L2 listening performance. Consequently, for example, MALQ could be quite useful in improving the learner's awareness of the processes underlying L2 listening (*op. cit.*: 2006).

Our study finally encourages L2 teachers (a) to use individual listening tools, such as computers or MP3-players, in classroom activities and (b) to explicitly teach ''input/intake'' self-regulation together with problem-solving, planning and evaluation strategies in order to strengthen the L2 learners' ''metacognitive'' awareness of the underlying processes at play in language comprehension.

Our results seem to show that certain pupils with poor linguistic knowledge have difficulty in using elaborate listening strategies. On the other hand, the pupils with good linguistic knowledge seem to be able to use more elaborate listening strategies and to plan their listening task judiciously. It seems to us to be possible to interpret these results in terms of cognitive load: the pupils with better knowledge have more resources free for using more elaborate strategies, contrary to those having poor knowledge. The use of metacognitive strategies represents an important cognitive load but is also a resource to facilitate comprehension.

Our results are also relevant in providing suggestions for what to tell students when training them in strategy use. Listening situations regulated by the teacher seem to help those pupils with poor knowledge, because for such students self-regulation can overload their working memory. If they do not have to control the listening task, they can better concentrate on low level comprehension processes like segmentation and translation without having to think about strategically high-level processes.

However, efficient strategies (such as, for example, listening to the speech once, identifying the difficulty and then deconstructing it) can be taught. For learning in CALL environments, we would encourage teachers to prepare guidelines for listening from which learners could choose specific instructions, depending on their initial level. It is necessary to provide poor listeners with very precise guidelines and to allow higher skilled learners more freedom to choose their own way of listening in order to develop their listening metacognitive strategies.

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