

Implementing autonomy: a rhizomatic model for pronunciation learning

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Abstract

The role of autonomy in language learning has long been discussed and there has been an increasing tendency among researchers to explore autonomous learning, especially with the shift from teacher-centred to student-centred learning environments (Holec, 1981; Little, 1995; Benson, 2007; Godwin-Jones, 2011). Yet, implementing autonomy remains problematic (Judy & Crookall, 1995; Gremmo & Riley, 1995) though computer technology has contributed much to facilitating autonomous learning (Godwin-Jones, 2011; Hayta & Yaprak, 2013). This paper deals with the implementation of an autonomous learning system for English pronunciation based on the verbotonal system of corrective phonetics embedded in a CALL environment (CALL-VT). Participants in this research were 48 Chinese EFL students enrolled in a formal pronunciation course. A questionnaire was developed and administered to the group and oral interviews were conducted before and after the intervention to evaluate students' learner autonomy. In addition, a diary was kept by each student. Results indicate that students' autonomy was developed significantly as was their pronunciation. Implications are drawn for the implementation of autonomy.

Keywords: *learner autonomy, pronunciation learning, personal learning environment, rhizomatic, verbotonal*

1. Introduction

The gaining of autonomy by language learners is widely seen as a valuable asset as argued and demonstrated by many studies over the last four decades (Holec, 1981; Little, 1991; Benson, 2007; Godwin-Jones, 2011; Snodin, 2013). This assumption is at the core of this study, the purpose of which is to investigate whether autonomy is actually developed in students as a result of procedures devised for that purpose and implemented in the context of a study designed to improve the English pronunciation of Chinese learners of English as a Foreign Language (EFL). Notably, this study does not seek to compare whether one form of implementation is better than another, but only to determine whether autonomy does in fact grow within a specific group of students subjected to a specific approach, perhaps as a prelude to a more sophisticated tuning of the procedures.

While the value of autonomy as a behavioral objective becomes increasingly established in foreign language learning, its implementation remains challenging and open to debate. In parallel with this development, we are

encountering an interesting occurrence in society in general where personal autonomy seems to be growing rapidly as a result of the impact of technological and communication tools together with greater access to information. As Lian (2011) noted, the world is more information-rich and communication-rich today than at any time in its history. Nowadays, people can easily access a great range of resources to obtain information and there is a tendency for people to manage their own learning on the basis of convenience and preference. In effect, we seem to be turning into a society of self-managing, do-it-yourself (DIY) researchers (Lian, 2011; Lian, A.B, 2014; Lian & Pineda, 2014), i.e. an autonomous society keen, and able, to manage its own information needs. In effect, autonomy is increasingly becoming a normal part of life as we become more able to access information on our own - and we enjoy this.

Chinese students tend to be low in autonomy (Yu, 2006; Liu, 2010; Guo, 2011) as they live in a heavily teacher-centered world, especially, when it comes to learning pronunciation. This is partly explained by the fact that they take the pronunciation teacher as their only model and

often waste much of their private study time because a teacher is not available when needed (Yan, 2008; He et al., 2014). Further, Chinese EFL students are especially weak in speaking and pronunciation as shown by numerous research studies (e.g. Zheng, 2010; Mak, 2011). In order to help solve the above problems, an innovative pronunciation learning system was developed which combined the verbotonal theory of corrective phonetics (Guberina, 1972; Renard, 1975; Lian, 1980; Guberina & Asp, 1981) with the use of computer technology, all embedded in an environment intended to develop a significant degree of learner autonomy. It was named the CALL-VT system. CALL-VT was designed to enhance perception through (a) signal manipulation (specifically through low-pass digital filtering), (b) the strengthening of perception and memory through gesture (Condon, 1971; Lian, 1980; Zhang, 2006), and (c) the provision of a simple software tool enabling students, in effect, to construct their own lessons at will (Lian, 2014) both in and outside class. The system was based essentially on a 2-phase approach for both perception and autonomy. Phase 1 consisted of sensitization based on a set of partially autonomous classroom activities where perceptual and other skills were developed to provide a framework for self-management and phase 2 consisted of reinforcement and enrichment activities occurring primarily outside class. Thus autonomy took place both inside and outside the classroom. Autonomy was not confined to outside-classroom activities, especially as perceptually unguided pronunciation practice can lead to fossilization of errors rather than improvement (Selinker, 1972, 1992; Acton, 1984; Demnirenzen, 2010). Classroom pronunciation work was designed to make the students perceptually self-sustaining thus enabling private practice to be effective.

2. A brief literature review of autonomous language-learning

The need for autonomy is postulated on the premise that all learners display significant individual learning characteristics which distinguish them from one another in unpredictable and unpredictable ways (Lian & Pineda, 2014) and that, for best results, learning ought to be personalized. Under these circumstances, given the great diversity of needs, it is also postulated

that the best persons to recognize and take charge of these problems are, ideally, the students themselves, thus maximizing their learning potential (Lian, 1987). Rhizomatic models (Lian, 2004, 2011; Lian & Pineda, 2014), which enable students to navigate through information and learning activities at will, meet these specifications. They are not restrictive in any way but give students freedom to investigate the best ways of meeting their perceived needs. While not providing a fully-fledged rhizomatic infrastructure (as it is too small) our system drew on rhizomatic philosophy for its intellectual base.

While the desirability of autonomy seems clear, many scholars have sought, and continue to seek, to define and understand the concept of autonomy from different angles. Holec (1981) regards autonomy as the learner's sense of responsibility. Little (1991, p.4) defines learner autonomy as "essentially a matter of the learner's psychological relation to the process and content of learning, a capacity for detachment, critical reflection, decision-making, and independent action". Autonomy is seen as the capacity for active, independent learning by Dickinson (1995) who believes that there are various levels of autonomy and he suggests recognizing these formally. Benson thinks that autonomy in learning is concerned with learners taking more control over their learning both in and out of the classroom (Benson & Voller, 1997; Benson, 2001). Keeping the above in mind, it seems that the notion of autonomy can also encompass other concepts derived from different domains such as politics and education, philosophy and psychology (Blin, 2004).

While the concept of autonomy in language education is continuing to receive focused attention, implementation of autonomy remains a broad field of investigation. For instance, Judy and Crookall (1995) identified the problems of implementation of autonomy within a Chinese cultural context. Importantly, the role of technology in achieving autonomous learning cannot be underestimated and its use in support of autonomous learning is increasingly important and is an integral part of the current research project (Schank & Jona, 1991; Gremmo & Riley, 1995; Levy, 1997; Murray, 1999; Hayta & Yaprak, 2013; Snodin, 2013; Yapici, & Hevedanli, 2014).

When discussing autonomous learning in current learning environments, one is reminded of the notion of rhizome and rhizomatic learning.

Originally, the rhizome was a philosophical concept developed by Gilles Deleuze and Félix Guattari in their *Capitalism and Schizophrenia* project (Deleuze & Guattari, 1987). In practical terms, a rhizome is a network of information and learning activities based on decisions generated by the connections and flows of our past and our present (including our choices and imposed actions, e.g. by teachers) to guide us into the future. From a slightly different perspective, Pineda (2014) understands rhizomatic learning as “an organic, developed system of habits, attitudes and personal practices of discovery, meaning-making and validation of what we perceive as knowledge”. Given these definitions, rhizomatic learning can be thought of as the “natural”, organic, way of learning, consciously or unconsciously, formally or informally.

These notions imply that rhizomatic systems are essentially needs-based and, as a consequence, are meant to meet the needs of learners as and when these needs are elicited. They take as their point of departure the perceptions and performances of learners as they actually happen and not as course designers might imagine them or even how a statistical model (e.g. a needs analysis survey) might predict they would happen. These principles are in harmony with the principles that govern verbotonalism, autonomy and computer enhanced language learning. The CALL-VT system embraces this philosophy and structures its activities and resources around all of these concepts.

3. The study

The current study aims to conduct a preliminary exploration of the development of learner autonomy of Chinese EFL learners in the context of pronunciation learning. The participants in the study were 48 first-year English majors in Xingyi Normal University for Nationalities. They learned pronunciation using CALL-VT in a self-regulated environment. Alongside our investigation of the effects of CALL-VT on pronunciation enhancement (to be reported separately), we examined the participants’ autonomy development. Two research questions were addressed in this related study: 1) Is student autonomy developed through the use of CALL-VT? If so, in what ways and to what extent? 2) How do the participants perceive their development of autonomy (if any)?

3.1 Research background and setting

The study reported here is part of a larger research project designed to assess pronunciation improvement. The specific aim of the current study was to identify the extent of participants’ development of autonomy when using the CALL-VT system.

The study took place in a 4-year B. A. program in English education where pronunciation was a compulsory subject.

3.2 Participants

The participating university had recently been accredited by the Ministry of Education (MOE) to offer bachelor degree programs. The participants in the present study were first-year English undergraduate majors in the School of Foreign Languages. They were majoring in English Education and most intended to become middle school or primary school English teachers. Aged 17-21, they were enrolled in a class of 48, the standard class size in this university being 40-50. All had studied English for a minimum of 6 years.

In order to comply with ethical requirements, a written consent form was filled out by each participant to ensure that all understood the purpose of the experiment and that they participated in the experiment voluntarily and were aware of all possible challenges and risks. In addition, prior to the start of the project, ethical concerns were cleared by the academic committee of the university.

3.3 The experiment

The experiment was conducted in the second semester of the 2014 academic year. Pedagogic sequences consisted of two sets of activities: inside the classroom and outside the classroom. While the purpose of this article is not to focus on the pronunciation component of the larger study, some understanding of the processes engaged in is nevertheless necessary, hence the following description.

3.3.1 *In-Classroom activities*

In the first phase (defeating students’ “deafness” to the sounds of English), a sensitization session was conducted in order to lighten the students’ cognitive process load (described below) and also to raise students’ awareness of the target language pronunciation

characteristics thus setting up their potential for independent learning. There were 7 steps in this phase:

Step 1: Students were asked to sit in their preferred position as relaxed as possible. The relaxation activities were adopted by the researcher from the suggestopaedia method (Lozanov, 2009). In principle, they could even lie on their backs on the floor if they wished. With the classroom quiet and dark, they engaged in a series of mind-calming exercises. Baroque music was played to further relax them, thereby making them receptive to the language input (Lian, 1980; Lozanov, 2009). Students were even free to play any mind-calming music that they could access through their own smartphones.

Step 2: This and subsequent steps focused on the perception and production of prosodic patterns of language (stress, rhythm and intonation) and not individual sounds as in traditional approaches to phonetics. Here, students repeatedly listened to natural language sequences digitally modified through a low-pass filter set at 320 Hz. Low-pass filtering has the effect of removing all vowel and consonant sounds (essentially the words) and leaving behind the prosody of language: stress, rhythm, and intonation (the melody of language) thus lightening their processing/cognitive load (no words and grammar as such to process, only beats and melody). Filtered sentences sounded as though they were being hummed rather than articulated and they were not intelligible in the usual way. Students listened to the filtered sentences at least ten times in succession. In the introductory lecture before the intervention, they were told that they did not have to understand the meaning of the sentences but just to listen. Once the consonants and vowels have been removed, the elements left behind, intonation and rhythm can be perceived and integrated more effectively (Renard, 1975). While students could not understand the detailed meaning of the sentence content, intonation does carry meaning and they were encouraged to guess the meaning of the intonation patterns themselves, e.g. "Is this a yes/no question?", "Is this a statement?" etc.

Step 3: While listening to the filtered sentences, students and the teacher hummed in unison to the melody and rhythm of the filtered sentences so as to practice intonation production (the fundamental frequency of the voice which is responsible for intonation - F_0 - is produced

primarily by the vocal cords: actually a form of humming). Humming is a way of practicing intonation-production without the burden of words). At various moments in the class, volunteers would spontaneously stand up and present their hummed versions of the studied patterns in order to demonstrate their understandings.

The idea behind the first three steps is to focus on the melody of the sentence without interference from consonant and vowel sounds, words and grammar, thereby reducing the processing load on the brain and the articulatory organs. At the same time, the use of low-frequency patterns preferentially activates the right brain where melodic signals are processed (Hesling et al., 2005) thus enabling better perception of patterns.

Step 4: The teacher and students clapped their hands to the rhythm and beat of the English language that they listened to. Students clapped and even danced. They walked hand in hand or on their own to "express their feel of the language" or to synchronize to the rhythm together (thus developing a joint awareness of the rhythm and communicating it to each other). In this step, on the one hand, students could hum and clap out the rhythm in their personal perceived ways. On the other hand, the teacher could also use this moment to present the correct rhythm to the students as a non-prescriptive model. This model was presented as a suggestion of the teacher's personal preferences and perceptions rather than as a prescription to be imposed. In other words, students were not required to model the teacher's gestures but created their own representations of appropriate movement to accompany speech production. As a result, students were able to experience more explicitly their understanding of the rhythm of the sentence at a physical level and to compare and contrast their personal understandings of the rhythm and melody of English against those of other students as well as the teacher's.

Step 5: Students and teacher "walked" the rhythm of the language presented with feet coming down on every stressed syllable. They used gestures to help express their perceptions of the rhythm and intonation since body movement and gesture were proposed as aids to intonation learning.

Step 6: The original unfiltered sentences were played. Students were required to mouth the words to the sounds of the filtered patterns but not actually utter any sounds. Mouthing the words is an intermediate step toward articulation of the full sentences and gives students an opportunity to practice the articulation of the sounds without placing them on a self-generated intonation background (which adds another layer of difficulty). Again this step is designed to reduce the load on students.

Step 7: Students were asked actually to fully utter the words which they added to the “language tune” that they had been learning. Original sentences were played continuously. Then, students repeated the sentences in chorus. The teacher checked and corrected students as necessary.

It should be noted that sequencing of the above steps was not linear and steps were not planned to occur in a fixed order. After listening to the filtered sentences approximately 10 times, the students were able to listen to the normal sentences and to make comparisons between filtered and unfiltered versions. They were free to choose to listen to specific filtered or unfiltered sentences of their choice as many times as they felt necessary. They could also record their voices and

play them back so as to compare their production with the models that they had been listening to.

3.3.2 Out-of-classroom activities

The above listed classroom activities made up one part of the experiment. The other part of the experiment consisted of self-managed pronunciation reinforcement exercises performed outside the classroom. Students were able to use a computer room set up to provide access to filtered sentences and other resources (like authentic models of native speakers) for pronunciation learning. They could listen to and practice what they had studied in class and could engage in other activities of their choice to improve their pronunciation. For example, they could make recordings of their voices and compare them with the correct intonation patterns or hum or gesture as they had been doing systematically in class.

A simple online computer assisted system was developed to help students to be self-managing. They could listen to filtered and unfiltered models and could practice and enhance their pronunciation of intonation patterns. At the same time they could essentially generate their own lessons by navigating through the entire set of course materials in a simple way. The graphic below shows the student interface.

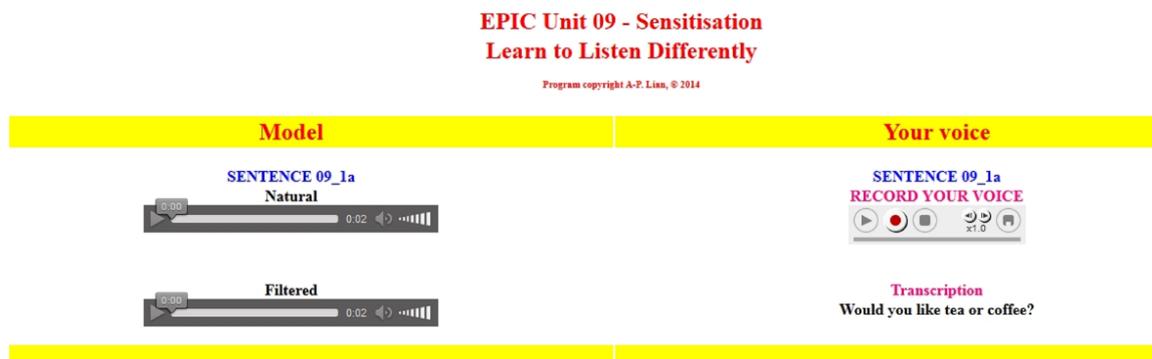


Figure 1 Student interface

3.4 Data collection & analysis

Since, for this experiment, pronunciation study was designed to take place in a self-regulated learning environment, it was important to conduct a special evaluation of the students’ levels of autonomy. In order to accomplish this, a self-assessment tool based on a dynamic model of

learner autonomy (Tassinari, 2012) was developed. The dynamic model and the descriptors developed by Tassinari are well-established as tools for determining language autonomy and have been repeatedly validated by experts from the Centre de Recherches et d’Applications Pédagogiques en Langues (CRAPEL), Université de Nancy 2 and

the Language Centre of the Freie Universität Berlin. A follow-up in-depth oral interview was administered for determining the nuanced aspects of their autonomy development. This semi-structured interview consisted of ten questions on when, what, and how the participants conducted and evaluated their pronunciation learning. Diaries of the participants were also examined to corroborate the findings from the questionnaire and interviews.

Before the experiment began, a questionnaire of 10 items from Tassinari's (2012) dynamic model of learner autonomy was administered. After a 14-week intervention, the questionnaire was re-administered. Next, ten participants were selected randomly and interviewed on their perceptions of their development of their learning autonomy. Finally, we collected and analyzed students' diaries where they recorded their learning activities. In addition, a pretest and posttest were used to evaluate students' pronunciation abilities.

4. Results

4.1 Answer to research question 1 (*Is student autonomy developed through the use of CALL-VT? If so, in what ways and to what extent?*)

In answer to research question 1, results from the questionnaire and diaries are given below.

4.1.1 Self-evaluation of pronunciation ability

As described in Table 1, at the beginning of the experiment, the general state of students' autonomy was not high as measured on a scale of 1 to 5. Not many students could evaluate their pronunciation ability on their own (mean = 2.21). They evaluated their pronunciation ability principally through a language advisor (mean = 3.56) or through a test (mean = 3.50). However, after use of CALL-VT, many of them claimed to be able to evaluate their pronunciation ability on their own (mean = 3.25).

4.1.2 Self-selection of pronunciation goals

While before the intervention, students had difficulty in setting learning goals on their own (mean = 2.85), after the intervention, many claimed to be able to do so (mean = 3.31).

4.1.3 Self-selection of time and place of learning

The greatest change was found in the time and place of learning. Before the intervention, students stated that they were unable to plan their time (mean = 2.75) and place (mean = 2.75) for learning pronunciation. After the intervention, most claimed to be able to plan their learning on their own in terms of both time (mean = 3.37) and place (mean = 4.19).

Table 1 Descriptive analysis of students' perceptions of their level of autonomy

Item	Before		After	
	Mean	S.D	Mean	S.D
1. I can evaluate my pronunciation ability on my own	2.21	0.97	3.25	1.01
2. I can evaluate my pronunciation ability together with a learning advisor	3.56	0.90	3.79	0.90
3. I can evaluate my pronunciation ability with a test	3.50	1.03	3.58	1.07
4. I can set myself goals on pronunciation learning on my own	2.85	1.20	3.31	1.11
5. I can set myself goals of pronunciation learning with a learning advisor	3.17	1.33	2.87	1.28
6. I can set myself goals of pronunciation learning with a test	3.17	1.19	3.35	1.26
7. I can plan a time for pronunciation learning for my learning on my own	2.75	1.19	3.37	1.25
8. I can plan a time for pronunciation learning with a learning advisor	3.19	1.10	2.85	1.24
9. I can plan a place for pronunciation learning for learning on my own	2.75	0.96	4.19	1.10
10. I can plan a place for my learning of pronunciation with a learning advisor	3.29	1.17	2.92	1.38

Note that the questions above and elsewhere are those normally used by the validated Tassinari (2012) inventory and focus on specific and established markers of language-learners' autonomy.

Data from the diary entries show that students were able to obtain more materials of a broader variety on the basis of their preferences and availability. For example, several student

diaries indicate the use of additional materials, either text or audio, from different sources such as the Internet and other courses rather than their official textbook.

With regard to time of study, diaries indicate that pronunciation learning activities were carried out a greater number of time periods than previously: many of them made use of the few minutes available at dusk and before bed,

something that they had never done before. One student mentioned his experience of tapping out a sentence rhythm while waiting in line in the canteen. More interestingly, not a few said that they hummed the intonation patterns in the shower.

In terms of place of study, they were found to study in more places than before, many in places previously unfrequented, such as by the fish pond, in the sports ground, and in the garden. One participant even practiced her pronunciation in the gym between work-outs.

4.2 Answer to research question 2 (*How do the participants perceive their development of autonomy (if any?)*)

In answer to research question 2 and also to triangulate and extend the above results, the researcher interviewed ten randomly selected student participants.

Data from the oral interview revealed that most students (9 out of 10) believed that their learner autonomy had grown after using the CALL-VT system. All interviewees claimed that the CALL-VT system had given them more freedom to choose the time, place, and materials for learning. For instance, even in the classroom, they could exercise their freedom of action by selecting and replaying recordings as many times as they wished. However, even though they were free to select learning materials of their choice, some (4 out of 10) expressed the wish to be provided with more materials by the system itself. Students' favorite activity was to work in the

computer lab where they could study on their own, another sign of comfort with autonomy. In addition, they also enjoyed working autonomously after class both in groups and on their own. As one interviewee said, "I prefer to study on my own when I try to imitate the prosodic patterns with dancing and gestures but I prefer to study in groups when I want to discuss things with my friends. Both are helpful, I think". In summary, they believed that the CALL-VT system was beneficial to their autonomous pronunciation learning.

While not reported here in detail, it should be noted that in addition to developing autonomy, as shown in Table 2, the participants' pronunciation ability improved significantly in the main component of the enveloping research project in the areas of phoneme production (remarkably with no specific training in phoneme production), comprehensibility and fluency in both rehearsed, unrehearsed, artificial and natural face-to-face conversation. This finding emerged from a larger project, of which the present study, with its emphasis on autonomy development, was an important component. To check the effect of the CALL-VT system in improving Chinese EFL learners' pronunciation, the main study used a control and an experimental group. It was found that while the experimental group improved in relation to their starting point, they also overtook and outperformed the control group against which they were being compared ($p = 0.001$) on almost all measures as rated by both Chinese expert and native speaker raters assessing blindly.

Table 2 Descriptive results of students' overall test scores

Group	Tests	Mean	Number	Std. Deviation
Experimental group	Pretest	70.89	48	8.38
	Posttest	84.93	48	6.48
Control group	Pretest	75.20	47	8.38
	Posttest	80.94	47	9.45

5. Discussion

The goal of the general research question was to discover whether there was any development in students' learner autonomy under conditions similar to those of systems such as CALL-VT. The study indicates a positive outcome. Further analysis shows the following.

First, students' motivation for learning pronunciation was highly activated. In a separate survey of their opinions (not included in this

article), they indicated that they had become more interested in learning and practicing pronunciation than before. This growing interest considerably enhanced their commitment to autonomy.

Second, students were free to choose any materials available on the basis of their interests or mere curiosity, and they clearly took advantage of this: a strong sign of autonomy. Students could, if they wished, produce their own filtered materials by self-filtering any sentences of interest, or even

their own voice, through audio editing software (e.g., *Audacity* or similar). After training in the classroom, they could listen to and compare recordings of direct relevance to their current interests as well as their voice. Thus they derived the “feel” of the target language and developed personal understandings of the intonations and rhythms that mattered to them.

Third, students grasped the opportunity to be more flexible in choosing the time and place of pronunciation study: a clear sign of autonomous learning.

Fourth, in both pretest and posttest, students stated that they would seek advice from advisors. The role of learning advisors in autonomous learning has been highlighted in many studies (e.g. Mozzon-McPherson, 2007) and the contributions of language learning advisors to the development of learner autonomy cannot be overlooked. Interestingly, a higher mean in the posttest ($M = 3.79$) than in the pretest ($M = 3.56$) for consultation with a learning advisor to help evaluate pronunciation ability does not indicate a drop in autonomy. On the contrary, this higher score indicates an increase in their level of comfort at the idea of requesting advice rather than waiting to be told what to do. That this behavior was actually a sign of autonomy rather than growing dependence is confirmed by the fact that, when it came to the planning of study time ($M = 2.85$), place ($M = 2.87$) of study, and other aspects of learning, students were comfortable studying without a learning advisor. In short, when one is autonomous, one asks for help when it is needed.

To summarize, the above analysis suggests that the verbotonal system of pronunciation learning is able to be embedded in a simple, rhizomatically-inspired, technology-supported autonomous learning structure. Importantly, the verbotonal approach, of itself, contributes to autonomy by reducing the processing load on the student, makes the intonation and rhythm more salient and raises students’ awareness levels (Lian, 1987; Schmidt, 2012). Listening to filtered sentences rather than natural sentences also provides students with attentional space to construct their perceptions. Finally, by presenting intonation and rhythm in an unusual way which by-passes their current perceptual mechanisms, students have the opportunity to integrate prosody more effectively into their logical and representational systems

(Lian, 2000, p.52), especially as the entire perceptual experience is enhanced through the use of gesture (Renard, 1975; Lian, 1980). This “hidden catalyst” is, arguably, part of the key to the increased autonomy observed. Being trained with the filtered materials, relating them to movement and having the ability to experiment with them on a private basis gives students new perceptual skills which effectively extends autonomy and makes them less reliant on others. These features, together, enable them to self-teach, to become largely independent of external support and to enhance their potential to self-manage more effectively, to take charge of their own lives (Benson, 2006), i.e. to become autonomous.

In turn, this new-found freedom enables students to have the liberty to do what they feel is valuable in a rhizomatic way as every new awareness adds to their freedom of choice and action which, ultimately, enables them to learn better. And they are assisted in this endeavor by a simple very flexible piece of computer software. In effect the verbotonal system and the rhizomatic structure are in a symbiotic relationship where one helps develop the other.

6. General implementation considerations

This article began with a concern about implementation. Autonomy can be either complex or simple to implement: no optimal implementation model has yet been identified nor, perhaps, can it ever be. While this may be disappointing to some, it is also perhaps not surprising as learning is a human and highly personal activity and human beings are remarkably diverse. If there is an answer to this issue, it might be found not in models based on a detailed analysis of needs and activities but on highly abstracted models which can automatically take account of student diversity. This is what the rhizomatic model attempts to be. From that perspective, the experiment described here may provide useful insights into the issue of implementation in highly diverse contexts where individual needs are essentially unpredicted and unpredictable. The following remarks provide a short commentary on the study’s findings.

(a) The system implemented is simple but worked: autonomous systems do not necessarily have to be highly complex or highly resourced. The system described here made use only of a relatively small number of pre-recorded, digitally-

enhanced materials coupled with auditory and gesture-based awareness-raising exercises. These were used at will by the students both inside and outside the classroom (after an essential introduction to the patterns to be studied and the procedures to be adopted).

(b) The above materials were used “at will” (see (a) above) because the course adopted a rhizomatically-based autonomous approach: an approach with no fixed structure or fixed content other than objectives. Students, either alone or in groups, constructed their own rhizomes or paths through the experiences and materials that they needed according to their perceptions of need as established both with and without the guidance and assistance of persons or machines. Use of a rhizomatic model does not imply chaos but the generation of an organic self-adjusting homeostatic, learning environment created by the learners in interaction with their personal learning environments, their learning materials and their tasks (for further details see Lian 2004; Lian 2011; Lian & Pineda 2014). The notion of Self-Adjusting Learning Environment (SALE) (Lian, A. B., 2014; Lian & Pineda, 2014) is not unlike the notion of Self-Organizing Learning Environments (SOLEs) suggested by Sugata Mitra in his hole-in-the-wall experiments (e.g. Mitra, Tooley, Inamdar, & Dixon, 2003).

(c) Use of a rhizomatic approach means that students are free to follow the path that best suits them. As these patterns are unpredicted and largely unpredictable, the curricular complexity of the course or learning system is reduced.

(d) While not theoretically required by rhizomatic theory, in fact autonomous systems can be significantly improved by the use of approaches and materials which have been enhanced to ensure optimal perception/reception of whatever is being studied (in our case spoken language but other forms of enhancement are possible). In the case of the above experiment, both low-pass filtering and synchronized body movement provided such an enhancement and actually enabled autonomy to develop in a kind of symbiotic relationship. In our specific case, the use of filtered materials facilitated autonomy and autonomy facilitated the use of filtered materials.

(e) From a resource perspective, a rhizomatic approach as implemented above, enables students actually to create their own resources and to supplement the materials provided.

In our example, students created their own filtered materials because they were interested in them or simply because they were curious. They were especially curious to hear their own voices filtered and were able to compare their filtered voices with the filtered models. Here there is no need for a bank of lessons and detailed curricula, but a set of flexible tools (in this case for recording and then filtering voice) which will enable learners to engage with materials and examine them from different perspectives of personal relevance to themselves.

While, clearly, these five steps are closely related to the specific research study reported in this article, they also offer insights into what may be called a minimalistic perspective on the implementation of autonomy and provide a model for other autonomous language-learning initiatives.

Interestingly, the above description can be abstracted further into the following simple three-level/-layer structure which, as suggested by Lian (2004, 2011) and Lian and Pineda (2014), can be generalized to all individualised or needs-based learning initiatives.

(1) A guiding intellectual framework: in this case two very closely related theories, verbotonalism and rhizomatic learning (basically treated as one since both essentially share the same principles).

(2) An operational space where needs are identified through action: the intonation learning space where needs are identified by students seeking to perform certain tasks and identifying their problems either through feedback from others (teachers, other students, friends) or self-analysis (inability to perform tasks linked to the growing ability to make more precise diagnoses of problems or goals and objectives as indicated above).

(3) A help and resource space: a space containing support structures consisting of pedagogic and non-pedagogic materials as well as human and/or non-human resources to help address the needs identified in (2) above. In our case, these are the filtered teaching materials, resources created or found by the students themselves and human members of each student’s personal learning environments.

Not surprisingly, the three layers interact with one another: activities in one layer will have an impact on activities in the other, especially between Layer 2 and Layer 3.

It should be noted that the environment for this experiment was not constructed initially on the basis of the three-layer model just described. It was based, in the first instance, on a traditional, directive, course structure but, once the intellectual framework was in place (Layer 1), it transformed itself through no special design plan into the three-layer structure just described. This, in turn, enabled autonomous activity in Layer 2 (and then in Layer 3).

6.1 Summary of key theoretical findings

The analysis of data produced by the above experiment suggests four theoretical conclusions:

(a) learner autonomy was improved within the verbotonal approach to perception and pronunciation study (including gestural support).

(b) the rhizomatic approach for developing autonomous, personalised learning environments is likely to be well-founded and contributes to autonomy.

(c) the three-layer structure for developing autonomous, personalised learning environments is likely to be well-founded.

(d) effective autonomy can be achieved in areas of study previously thought to be immune to autonomous implementation (e.g. pronunciation) provided that proper awareness-raising conditions are set in place (as in our case).

The above form the primary theoretical outcomes of the study and all four can be generalized to other contexts and serve as the basis of other experiments with other systems/courses.

6.2 Limitations of the study and suggestions for future research

The primary limitations of the study are that it was small, constrained by physical facilities and by institutional requirements. Larger replication studies need to be performed together with experimentation with both the three-layer model and the notion of rhizome, particularly in relation to how students can learn to make good decisions whenever they encounter a decision point. Future investigations may also develop more refined information-collection systems and engage in deeper observation of students in action to determine the potential universality of these systems. Encouragingly, the success of this experiment provides an optimistic background against which to continue investigations. The

nature of the study being a preliminary exploration entails that further research involving a control group is needed to compare students' autonomy development in different pronunciation learning settings.

7. Conclusion

This article began with a concern relating to the implementation of autonomous language learning systems. It described the integration of autonomy into an experimental course designed to test the effectiveness of a specialized form of perception-based phonetic intervention (verbotonalism) within a CALL environment, namely, CALL-VT. From the findings, it is clear that the sought-for improvements (in pronunciation) were achieved and that they appeared to be closely-related to autonomy development as determined by questionnaires, diaries and interviews. Furthermore, it becomes clear that thanks to the theoretical models used (verbotonal theory in a symbiotic relationship with rhizomatic theory), there is no necessity for autonomous systems to be complex. Implementation of autonomy can be simple and achievable rather than complex and unattainable. The discussion that followed the description of the project generalized the above results to suggest a general model of autonomy combining awareness raising with freedom of action which, while needing further investigation, already appears to hold promise as a consequence of the progress achieved by students in this experiment.

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