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### Applying chaos theory to lesson planning and delivery

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## **Applying chaos theory to lesson planning and delivery**

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In this article, some of the ways in which thinking about chaos theory can help teachers and student-teachers to accept uncertainty and randomness as natural conditions in the classroom are considered. Building on some key features of complex systems commonly attributed to chaos theory (e.g. complexity, nonlinearity, sensitivity to initial conditions), and using examples from student teachers' descriptions of problematic classroom situations, the author finds these features of complex systems highly relevant for language teaching. The author suggests that teacher educators should help students to accept the complexity and unpredictability of teaching as natural conditions and become 'agents of chaos' in the classroom. In order to accomplish this task, teacher educators should accept the complexity and unpredictability of their own teaching environments, thus creating new possibilities for their students' learning and development as teachers.

**Keywords:** chaos theory; foreign language teaching; teacher education; lesson planning; reflective report

### **Introduction**

The language classroom, and the same is probably true for any classroom, is often described as 'chaotic'. With the emergence of chaos (or complexity) theory in the second half of the previous century, notions such as complexity, nonlinearity and unpredictability have become objects of increased interest of professionals in practically all spheres of life including education and teacher education. In this article the author considers some of the ways these and other notions, now commonly referred to as features of complex systems, can be relevant for language teaching.

In the first section of this article (Background) the author describes some paradigmatic changes in the conception of society and the role of education in the modern world, and how these are reflected in foreign language teaching. In the central part of the paper (Chaos theory and its relevance for lesson planning and teaching), the author suggests, by referring to the key features of complex systems and by using examples from his student teachers' descriptions of problematic classroom situations, how the features of complex systems can be relevant for foreign language teaching. In the concluding part of the paper the author suggests some of the ways teacher educators could help student teachers to prepare for the complexity and unpredictability of the classroom and language teaching.

### **Background**

In recent decades, the conception of teaching as a knowledge-based profession and teachers as committed professionals and reflective practitioners has become firmly embedded in many teacher education institutions in Europe and beyond. This new

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understanding builds on the changed conception of society and the role of education in the postmodern world, and is characterised by concepts and notions such as the postmodern condition or postmodernity (Lyotard 1984; Maclure 1995), reflexive modernisation (Beck 1992; Beck, Giddens and Lash 1994), reflective practice and the teacher as reflective practitioner (Schön 1983, 1987; van Manen 1995, 1999), classroom research and problem-solving (Richards and Lockhart 1996; Kansanen 1999), a move from teaching to learning (Barr and Tagg 1995; Jarvis 2007), etc. Similarly, the increased focus on competences and learning outcomes as a basis for higher education study programmes, now commonly referred to as the Bologna process (see the Bologna documents, e.g. the TUNING Project 2003), reflect a paradigmatic change in the societal conditions in which educational systems in most modern countries now operate. There is an evident need for higher education institutions to respond to the changing environment, which is in many ways 'culturally alien to the traditional university' (Duke 1992, 7).

The above paradigmatic changes are also true for language teaching and teachers. New concepts and terms such as the post-method condition (Prabhu 1990; Richards 1990; Kumaravadivelu 1994; Richards and Rogers 2001), the reflective approach/model (Wallace 1991; Tripp 1993; Richards and Lockhart 1996; Zeichner and Liston 1996; Edge and Richards 1998), principled pragmatism as an alternative to method (Brown 1994; Richards and Rogers 2001), and macrostrategies as the operating principles in teaching (Kumaravadivelu 2003), are concepts and terms that characterise the end of the century-old search for the best method (Prabhu 1990). The traditional models of teaching (e.g. the presentation-practice-production model for teaching new language) are being replaced by concepts that put more emphasis on the learners and the conditions for achieving learner involvement, on negotiated interaction in the classroom, on task-based learning (Willis 1996), and, specifically as regards grammar teaching/learning, on learners' language awareness and identification of language forms and meanings (Thornbury 1994). There seems to be a general agreement in the field of (foreign/second) language teaching that it should 'exclude any one methodological model' (Woodward 1996, 7), and that it should be based on communicative activities that focus on meaning and encourage information processing (e.g. guessing, problem-solving, role play).

The process of change, however, is not without resistance, and many teacher education programmes are still based on the conception of technical rationalism (Schön 1983; Eraut 2000). Many language teachers and teacher educators still believe that language is best taught when it is broken down into easily presentable 'building blocks', and this view is shared by authors of many mainstream coursebooks. These coursebooks, including most recent ones (see, for example, *Messages* by Goodey and Goodey 2005), are typically organised in a step-by-step manner, where the content is arranged in modules, which are further divided into units, each of these consisting of a sequence of 'manageable' steps. As the authors state, 'clearly defined objectives of each step allow learners to immediately apply the learnt knowledge in practice' (*ibid.*, cover page). Similarly, many of the self-proclaimed 'communicative' tasks offered by the coursebook are, in fact, intended for practising a specific function or skill while neglecting meaning. In these coursebooks, the use of task-based learning – an approach where language forms are not prescribed and the learners are free to use any language in their completion of the task (Willis 1996) – is still more an exception than common practice. The common truth that, for most practising language teachers, the

(usually prescribed) coursebook serves as the annual teaching plan (syllabus) also means that lesson preparation and planning are often reduced to more or less direct translation of the orderly structured coursebook syllabus into the complex and unpredictable world of the classroom. Coursebook publishers also contribute to the above problem by providing teachers with templates for annual lesson plans; these, naturally, closely follow the syllabuses of the coursebooks they are hoping to sell. The resulting mismatch between the formal (pre-planned) and actual (implemented) lesson or classroom activity represents a problem familiar to all teachers; for student teachers, however, the described mismatch often causes a feeling of increased anxiety or fear. The following excerpt from a student teacher's report on an observed lesson (taught by an experienced teacher) illustrates this feeling. Sonja, a third-year student teacher, writes:

Then the teacher came, put the radio on the table and put her hands in her trouser pockets and waited ... and waited ... There was no response whatsoever. The chaos was pretty much the same as during the break. Laughing, talking, screaming, eating, chewing gums, walking, talking on the phone, nothing changed even though she was there. After about 3 minutes she raised her voice to calm them down. Anyway, after some 'reasonable' time she finally managed to get some attention. I felt fear, anger and despair. In one moment all my expectations fell down; it was like sinking into a deep well. There were some questions appearing in my mind all the time: 'What's going on?', 'Why is this happening?', 'Isn't she going to do something to prevent this?', 'What about me...I'm about to teach this bunch of wild troops (sorry for the expression) on Wednesday!', 'What am I to do? They will eat me up for sure...!'

As teacher educators who supervise or assess lessons taught by student teachers and their mentors well know, the anxiety and fear expressed by student teachers before lessons rarely come true. On the contrary, evidence from research (e.g. Furlong and Maynard 1995) and from observed lessons and post-lesson reports and self-evaluations (Cvetek 2002) confirm that, for most student teachers, the first teaching encounters are a highly positive experience. In the following excerpt from a student teacher's reflective report on a taught lesson, Sonja describes her surprise at her students' behaviour during the lessons she taught:

Paralysed as I was I put the transparency on and got the courage to greet the students and ask one individual to help me read the dialogue. I was surprised to see how willing he was to cooperate. Some ten minutes ago I was praying to God to get at least some of their attention. Then I got all the attention I needed. As I was standing there, being in a position of the teacher, I had the chance to see them in a whole new perspective. (...) Of course everything didn't go smoothly in that lesson. At one point learners didn't know what they were asked to do. There was a gap between reading the dialogue and working in groups. Something was missing. I had to improvise and include an activity that wasn't planned. At the end I was glad I taught that class and for overcoming my fears. 'No one ate me, that's for sure!'

Although inexperienced, Sonja seems to have found the right answer to the problematic and unpredictable situation in the course of the lesson by taking a novel (unplanned) and unpredictable – that is, unknown to her before that moment – action which subsequently led to the successful end of the lesson and her satisfaction with her role as teacher. Lacking more detailed information about the action that she took (the report does not provide any details about the activity), we cannot evaluate the effectiveness of Sonja's response to the problematic situation. Her decision to improvise and change the course of the lesson as a response to an unexpected and problematic situation, however, represents a kind of behaviour that has become

characteristic of the work of professionals in modern working environments or systems, which are often described as complex and unpredictable or, in one word, chaotic. In recent decades, the behaviour of chaotic (complex and unpredictable) systems has become an object of increased interest and study, also among educationalists. The theory (or science) commonly related to dealing with complex and unpredictable systems is called chaos or complexity theory/science (Larsen-Freeman 1997a).

### **Chaos theory and its relevance for lesson planning and teaching**

According to a common definition, chaos theory ‘describes the behaviour of certain nonlinear dynamical systems that under specific conditions exhibit dynamics that are sensitive to initial conditions’ (popularly referred to as the ‘butterfly effect’ ([http://en.wikipedia.org/wiki/Chaos\\_theory](http://en.wikipedia.org/wiki/Chaos_theory))). The metaphor, which originally refers to so-called ‘Lorenz’s experiment’ (Rae undated), proposes that just a small change in the initial conditions can drastically change the long-term behaviour of a complex system such as weather or climate. The statement is likely to strike a chord with teachers, since it is certainly true in classroom teaching that even a small change in the behaviour of a constituent of the classroom system – for example, an unexpected remark from a learner, a slight change in the way the teacher conducts an activity – can have a major impact on the course of the lesson and its overall effectiveness. The opposite, of course, is also true: little or no change in conducting an activity can lead to boredom and passiveness on the part of learners. The following excerpt from a lesson observation report (written by a student teacher after observing the teaching of another student teacher) may serve as an illustration of the above conflict. Sonja writes:

Nina prepared well for the lesson. She brought many visuals to draw their attention. Her voice was soothing. (...) What I missed was the conversation between the students. Asking questions, being actively involved in the exercises, not feeling afraid of asking questions when they don’t understand something. They cooperated, but they did exactly what she told them. (...) I missed this individuality and autonomy. I missed unexpected moments when you suddenly find yourself out of context and you need to adjust to the moment and then find the red thread again. The unexpected is always challenging and it contributes to your development as a student teacher. The more provoking and challenging moments the better.

As a teacher educator, I remember Nina as a bright, serious and hard-working student, one of the best in her generation. It is true, however, that as a teacher, Nina did not excel. Although she was always well prepared for the lesson, and her lesson plans were detailed, logically structured and contained a variety of well designed activities for language use, she could hardly maintain student interest during the lesson and she also had a constant struggle to keep the disruptive noise in the classroom to a level that still allowed her to work. Sonja’s observations clearly reveal an important, perhaps crucial question of classroom teaching: how to combine the logical and orderly nature of traditional lesson preparation and planning effectively with the uncertainty and complexity (unpredictability) of the language classroom and lesson delivery.

A standard lesson plan traditionally aims to provide a clear and logical sequence of activities that the teacher will use in order to achieve the aims set for that lesson. When preparing a lesson and writing a lesson plan, student teachers follow the

guidelines for dealing with various pieces of background information and details of the lesson in question, such as lesson aims, learner characteristics, materials and the aids that will be used, learners' assumed knowledge and anticipated problems with suggestions for solutions. When writing their lesson aims, for example, student teachers are required to give brief, clear statements or descriptions of their teaching intentions for that particular lesson in terms of what the learners will (or should) be able to do as a result of their teaching. They can write, for example, 'Learners will be able to use different ways of talking about the future'; 'Learners will speculate on past events by using the structure 'could/should have + past participle' or 'Learners will express feelings by using words and phrases such as ...' In a similar fashion, student teachers plan (usually by using the coursebook) the teaching/learning procedures and activities. As often happens, even to the most able and hard-working student teachers, neatly designed procedures and activities are of little use when they are faced with the unpredictability and complexity of classroom situations.

Sensitivity to initial conditions (or 'the butterfly effect') is, however, one of many features that characterise complex systems. According to Larsen-Freeman (1997a), complex systems are also dynamic, complex, nonlinear, chaotic, unpredictable, open, self-organizing, feedback sensitive, adaptive, 'strange attractor' (a global pattern but unpredictable details), and fractal (one pattern repeats itself at different scales). In the following few paragraphs, I will briefly comment on some of these characteristics from the viewpoint of their relevance for the foreign language classroom.

To begin with, a language classroom is a good example of a *dynamic* system. As Larsen-Freeman (1997b) suggests, changes in learners' interlanguage are so rapid that it is impossible to know when the learners will actually be able to use a language item or structure accurately, meaningfully, and appropriately. According to Ellis (1990, in: Kindt et al. 2000, 2) it would be wrong to assume that a learner's understanding of a verb tense will remain the same, even over the duration of one activity. Still, the tradition of lesson preparation and planning procedures demonstrate a rather static view of language and how it is learned.

Language is also a *complex* system, composed of many subsystems (phonology, morphology, syntax, etc.), and any learning situation is influenced by factors such as teacher and learner characteristics, interaction patterns, methods and materials, and by external factors, even the time of day. The excerpt (taken from a student teacher's report on a taught lesson) illustrates how calling a student by the wrong name can significantly change the course of the lesson and influence its effectiveness. Sonja (fourth year) writes:

First, I asked the learners to write their names on a piece of paper, so that I could call them by their names. While we were practising I had to call them out to do various exercises. So I called a boy, named Janez. They started to laugh and even he was laughing. I asked them if something was wrong and they told me that his name was not Janez, but Sašo. Rather than seeing the situation as unfair I used the opportunity to make conversation out of this. I asked him what his real name was and why he used the other name. I also told them that real Slovenian names were rare nowadays and that I did not like foreign names being given to our children. I asked for their opinions and included them in the lesson; they had to report their likes or dislikes about the names.

The *nonlinearity* of language learning, as with any learning, is also not unknown to teachers. The '-ed' regular past tense is a good example. The process of learning begins, as Mallows notes (2002, 4, see also Lightbown and Spada 1993) with 'a period of correct, if limited, use, which is followed by a period of chaos as exposure

to the language increases, and generalizations and random use creep in. There is no way of knowing when this may happen with a particular learner, and we cannot predict when the process will end'. Language learning is also *chaotic* because every student learns in a unique way, although there are certain stages that all learners seem to go through, e.g. Krashen's 'i+1' (Kindt et al. undated, 3). Furthermore, it is *unpredictable* and cannot be reduced to any simple set of rules (Horgan, 1996, in: Kindt et al. 2000, 3). Last but not least, it is sensitive to initial conditions; a small change in the behaviour of a part of the system can greatly influence the behaviour of the whole system. The following example aims to illustrate how this and the other features of complex systems influence the course of a language lesson and its overall effectiveness.

In a classic (foreign) language classroom activity called 'Find Someone Who' (see Helgesen 1998) students walk around the classroom with a list of questions, ask the questions to a partner, write the answers and that person's name and then choose another partner and so on. The level of choice and related complexity and unpredictability may vary (according to the activity aims and context) but the 'moving force' of the activity remains the same – randomness and unpredictability. It seems to be reasonable to expect that an activity containing these two characteristics should be effective. But the 'law' of unpredictability applies here too, as will be illustrated by the following excerpt from a student teacher's report on a lesson. Tamara, a third-year student teacher, writes:

When writing a lesson plan, I remembered an activity called 'Find someone who'. My mentor had said they already had a basic idea how to use *will* for expressing future so I presumed they would have no problems going around the class and asking their schoolmates questions such as, 'Will you go for a walk in the afternoon?' or, 'Will you do your homework in the afternoon?' (...) After giving the instructions I explained what they had to do one more time and asked the learners whether they understood. It seemed everyone understood but there was no response in the beginning. The learners would not stand up and go around the class to perform a perfect communicative activity.

What went wrong? Which of the above features of complex systems (such as classrooms) contributed to the problematic situation? And what is the successful solution? For it is evident that Tamara successfully dealt with the problematic situation and brought the activity to an end. This is what she writes:

I felt I had to do something so I actively took part in the game. I had done this activity several times at different scout meetings so, I thought, why not doing it now with a couple of teenagers in the classroom. When I loudly started to ask learners questions, they also started to do the activity and collect information from their schoolmates.

Do we see *sensitivity to initial conditions* in the way Tamara responded? Her action – initiating the activity herself – changed the course of events, which subsequently led to a successful end of the activity. And, the unexpected turn in classroom interaction reveals the *openness* of a complex system (the classroom), and its ability to build new structures or patterns as the components of the system interact. Also, Tamara's response to the problematic situation characterises the *sensitivity to feedback* and the adaptive ability of the classroom as a complex system. The (student) teacher's novel use of a standard technique shows that she is able to learn and adapt to changed circumstances in teaching, accept uncertainty and, even more, use the new and unpredictable situation to build new relationships and possibilities as teacher. By

responding to the problematic and unpredictable situation in the way she did Tamara herself became a chaotic element in the classroom.

One more thing in Tamara's response deserves our attention, and this is the fact that by initiating the 'Find someone who' activity, Tamara, the teacher in that lesson, became a 'bird in the flock', another metaphor used for describing the behaviour of complex systems, and one which has recently become an object of increased interest in fields such as management, leadership and administration. As has been suggested (Waldrop 1992, in: Marshall 1996), the functioning of a complex system is generated by a rather simple set of rules, something similar to the flocking behaviour in birds which, as the author suggests, emerges from individual relationships and consists of three simple rules: (1) maintain a minimum distance from other birds (or objects in the environment), (2) match your own velocity with the birds in your neighbourhood; and (3) move toward the perceived centre of the mass of the birds. With these three simple rules, the author claims, a flock forms every time in a 'bottom-up' manner since the focus of each bird is on ongoing behaviour and not the final result (*ibid.*). It is not hard to see the functioning of at least two if not all three of these rules in the situation that was initiated by Tamara's response: the achievement of proximity (physical, communicative, emotional) with the learners (other birds in the flock), and (not supported with evidence but highly probable) the adjustment of the activity (speed of interaction, complexity of language) to the level of the class. This is what she writes in her post-lesson report.

However, I have learnt that as a teacher you must be alert all the time and recognize problems that might occur during an activity. It is also important to have a plan B and, of course, to participate in an activity. The teacher must set an example in every activity that is done in the class.

The above extract, although brief, clearly demonstrates how new knowledge and skill, based on experience, along with reflection on that experience, take the form of principles or macrostrategies (cf. Brown 1994; Kumaravadivelu 1994) which will in due time form that (student) teacher's teaching methodology. Tamara's active response to the problematic situation and her reflection on the experience demonstrate a willingness to accept the complexity of classroom teaching and build new understandings by taking an active role as an agent of complexity and unpredictability.

## **Conclusion**

Based on what was said above, we can say, that, if anything, our task as teacher educators is to help students to accept complexity and unpredictability in the classroom as natural conditions and become, as Lorenzen (undated) states, 'agents of chaos' in the classroom. This can, however, be accomplished only if we accept the complexity and unpredictability in our own teaching/learning environments not only by responding to problematic situations in novel and unpredictable ways but also by 'chaotising' our classrooms according to the principles of chaos (complexity) theory. By 'chaotising' our teaching we can establish new relationships, a new kind of order in our classrooms, which will – according to the 'laws' that govern the behaviour of complex systems (such as classrooms) – last only until another agent 'chaotises' the newly established order and so on.

As regards lesson preparation and planning, we should help our students (future foreign language teachers), plan for the complexity and unpredictability of the



classroom. Thus, when observing lessons and doing observation tasks, student teachers should pay less attention to filling out 'little boxes' (Prodromou 2002, 6), lengthy checklists of features to be observed, and more attention to the possibilities that arise from a multitude of actions initiated by the participants in the teaching/learning process and how these affect the course and effectiveness of the lesson. Similarly, when preparing their lessons, student teachers should be less concerned with writing detailed objectives and explicitly stated outcomes, and more with 'imagining' and devising possible classroom (lesson, activity/task) scenarios and their possible or desired responses to different situations that might emerge. When writing lesson plans, they should thus pay less attention to detailed descriptions of classroom activities and teaching procedures, and more to their creating 'mental images' (Stevick 1982) of their teaching activities and the lesson as a whole. By creating these images, student teachers have the freedom to generate their own situation-specific procedures and classroom techniques. This is what Sonja, for example, did in her lesson. She writes in her post-lesson report:

There was the activity where I wanted them to ask me any question they liked. One student asked me if I had a boyfriend. My mentor stood up and felt the question was inappropriate and that he shouldn't be asking such personal questions. I thought it all right and I answered the question. In my opinion students shouldn't be silenced if they find something interesting. You always have to make a constructive conversation, receiving and giving enough.

This short extract has much deserving of comment. Firstly, by inviting her students to ask questions they liked Sonja, in some sense, 'gave chaos a chance'. Secondly, by answering their questions, Sonja, as we can suppose, created new, spoken and unspoken, questions in her students, thus further expanding the context in which language is used in a meaningful, creative and communicative way. And thirdly, by reflecting on her experience and arguing her point, she demonstrated her growing professional competence and autonomy as a (student) teacher. The whole extract, however, demonstrates Sonja's determination to respond to new, unpredictable and problematic situations in the classroom. Although her responses to unpredictable and problematic situations may be seen as improvisations, they, in fact, bring order to the 'disorder' created before. The interplay between order and disorder in teaching is, without any doubt, a characteristic that all 'good' teachers share. The same is true for jazz musicians: '[G]ood teachers or even good curriculum designers are like jazz musicians responding and improvising to the critical points in their music. As they play, implicitly or explicitly, they recognize there is order in the disorder of their worlds' (Iannone 1995, 3).

### Notes on contributor

Slavko Cvetek works as a teacher educator (English Language Didactics, English for Specific Purposes) at the University of Maribor. His professional interests include teacher professionalism and professional development, and teaching and learning in higher education.

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