

# A Systems View of the EFL Class: Mapping Complexity

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## Abstract

Teachers have always known that the language classroom is a system; that every factor within that system is mutually reinforcing; and that teachers and students together create a mini-society, with its own characteristics, properties, roles, restrictions and expectations. Until the qualitative research paradigm appeared, however, the predominant method of researching this learning environment was to identify and examine contributory factors in isolation, in the manner of experimental science, in the hope that *rigorous* and *objective* investigation would reveal methods of making learning both more efficient and effective. The physical sciences from which this approach was borrowed have since moved on to a different view of reality, however, and in seeing the universe and its components as complex dynamic systems, have devised new methods for investigating them. Model theory and systems theory thus provide a means of exploring items in terms of their internal *connectivities* (interactions) and their external relationships with their surroundings. In view of these considerations, this paper suggests that EFL research should build on recent advances in scientific thinking, and should adopt systems theory as a means of investigating and describing the language class. In this way, a more comprehensive picture of the factors involved in learning can be drawn. (202 words)

## I. Introduction

Ancient Greek and Chinese philosopher-educators defined education holistically, talking of education of the whole person, and of awareness of man's position within the universe. According to this view, the species is part of a greater whole, and should understand its responsibilities and possibilities within that context. These views were modified by the mysticism of the "Dark Ages" and the empiricism of the Renaissance, before a mechanistic, cause-and-effect view of the universe appeared, spawning the Industrial Revolution. From this world-view, learning was seen in deterministic terms, which eventually gave birth to a behaviorist school of thought in which man was seen as a machine making predictable responses to given stimuli. According to this view, the role of language research was to discover appropriate stimuli which would predictably and reliably trigger the response of effective language learning. This approach mirrored the view of contemporary scientists that if the position and velocity of every atom in the universe could be known, then the future could be predicted with certainty. Relativity and quantum mechanics changed this view in the 20th century, when it was shown not only that the position and the velocity of atoms could not be observed at the same time, but also that atoms can be in two different places at once (Horgan, 1996). Further to this, Labov's paradox took on an added dimension when it became clear that the very act of observing electrons forced them to choose a state and location; prior to this, they existed in indeterminate states (decayed or undecayed). Schroedinger's "Cat theory" described the situation in which a cat in a box can exist "in two superposed states: both dead and alive" (Horgan, 1996). Finally, and significantly in terms of current complexity theories, classical (Newtonian) physics was unable to solve a problem of fundamental interest in physics: the "Many-ball problem" (Brown 1972), in which bodies not interacting in a simple linear fashion could not be described according to the Laws of Motion.

Taking a more holistic view of reality, the physical sciences have recently acknowledged new fields (e.g. Chaos and Complexity theory, cf. Waldrop, 1992) and have discarded the isolationist

methodology of researching individual factors out of context. Thus, model theory and systems theory view every aspect of our world from a perspective in which the whole is greater than the sum of its parts. According to this view, it is the connectivities (interactions) inside a system that determine its character and that control its dynamics. From these unpredictable interactions, larger structures emerge, taking on new forms. If the researcher is to investigate the characteristics of any *natural* system, therefore, whether it be a forest, a tree, or an insect, it is necessary to look at the subject in its context, and to describe the interactions that take place between the subject and its environment. Thus, the tree can be defined as a living organism which exists in symbiosis with other living organisms (insects, birds, animals, plants, bacteria), and which interacts with the soil, other trees around it, and the climate. In order to understand the tree, the researcher needs to take all its surroundings and interactions into consideration, rather than studying its parts (e.g. a leaf) in isolation. The tree is more than the sum of its constituent parts, since the way it grows and interacts with its environment determines the shape it takes and its success as a living system.

In view of these considerations, this paper investigates how EFL theory and research might profitably learn from current trends in the physical sciences by similarly dispensing with an isolationist view of research, and instead taking on a systems view of the language class. According to this changed perspective, aspects of the class and its participants could be investigated in terms of their interdependencies; by viewing all the factors as mutually influential, learning could be seen as an outcome of organised complexity, which, being unique to each class, would demand a flexible view of the learning process from the teacher. According to this view, each learner would be seen as a system (an individual personality) within a system (the class) within a system (the learning institution) within a system (the national education system). On the one hand the learner would be seen as a collection of beliefs and attitudes formed outside the classroom from interactions with parents, TV, comics, movies, pop-culture, etc. On the other hand, he/she would be seen as bringing these attitudes into a community of similar learners, further interacting with them, with the teacher, and with the institution. In this way, a picture could be built of contributory factors such as affect, culture, social awareness, cognition, roles, restrictions, expectations, and institutional requirements.

Once the researcher had adequately described the characteristics (behaviour and context) of the “open system in a steady state” (Laszlo, 2002, p. 32) that is the EFL class, and the ways in which component factors typically interact, the teacher would be empowered to view learning from a systems perspective, and consequently to view his/her classroom as a system in which effective, efficient learning could emerge from its connectivities. .

## **II. EFL research paradigms**

The experimental objective research methods which were effective in fuelling the huge mechanical advances of the Industrial Revolution have shown few such tangible results in the social sciences, and in EFL research in particular (Lightbown, 2000), though many in the profession continue in the propositional mode. By factoring out “extraneous” factors and isolating the subject from its context, it is assumed that data can be examined in its pure form, without fear of distortion. According to this approach, the learning process is the result of its components, which simply need to be examined in isolation in order to understand their combination. Early research into applied linguistics thus concentrated on breaking the language down into its parts and experimentally dissecting these. It was expected that resultant findings would enable learners to comprehend and master target linguistic code effectively, though it was left to the learners to transform language usage into use (Widdowson, 1978). Consideration of intra/interpersonal factors and the learning environment itself has little place in such research, since these are seen as external and irrelevant in the study of language.

Dissatisfaction with a behaviorist, formal view of language learning and research led to adoption of the student-centered approach, in which it was recognized that affective factors (e.g. confidence, motivation, attitudes and anxiety), are more important than cognition in language learning (Stern, 1983, p. 386), that beliefs control learning (Cotterall 1999) and that students do not learn what the teacher teaches (Allwright, 1984). If language acquisition were to be described in this context, then it would have to acknowledge the implications of non-linguistic determiners of learning and the

social context in which learning occurs. The time had come to abandon the objective research paradigm in favor of a more subjective approach which would see the learner as the originator and controller of his/her learning, and which would examine the beliefs and attitudes which, though being by definition subjective, represented reality for the learner (Rogers 1951). Researchers thus focused on qualitatively describing the process of learning and by documenting case studies which claimed neither to be generalizable nor inferential. Such studies essentially reported on the classroom as a system (though this perspective was not referred to at the time), reflecting changes taking place in the physical sciences, which had by the end of the 20<sup>th</sup> century revisited the views of the ancient philosophers, viewing the universe and man's place within it from the holistic perspective. This new systems view of research focused on organisation rather than isolation; instead of dissecting the subject into parts and further examining these in isolation, it observed the organisation and the interactions that held the parts together. Supraorganisms (Laszlo, 2002, p. 27) such as the human body could be seen from this perspective as open systems of ordered complexity, continually receiving input, and therefore not conforming to the second law of thermodynamics, which states that closed systems tend toward entropy.

### **III. A new approach**

In 1997, Larsen-Freedom wrote an informative and seminal article on complexity and its potential impact on the social sciences. Since then, however, there has been little written on this topic (cf. Van Lier, 1996, p. 148), and complexity in the EFL classroom continues to be difficult to research. Describing the language class from a systems perspective, showing how the interactions (connectivities) of components in the system are the essential building blocks of future unpredictable structures which subsequently emerge, implies monitoring every aspect of every classroom moment, from every possible perspective, identifying and documenting emerging learning structures – a daunting task for any researcher. Concepts which might be investigated include the “avalanche effect”, which predicts that minor events can have outcomes out of

proportion to their input: a pebble being thrown onto a pile of pebbles on a mountain can trigger a landslide; a butterfly flapping its wings in South America can initiate a hurricane in Puerto Rico; a straw can break a camel's back, etc. These examples tell us that the final "global" outcome (the landslide, the hurricane, the broken back) are predictable, and will occur. The exact moment of occurrence, however, and which pebble, flap, straw will trigger them off, is unpredictable at the "local" level. Thus we can predict with reliability that it will rain in Seoul on a given day (global level), but we cannot predict that it will rain in a given playground in a given school in Seoul (local level). In the same way, we can view input in the language classroom as having the potential to spark an avalanche of learning and positive effects, though we must also recognise that minor instances of negative input can also have disproportionately magnified outcomes.

When considering Larsen Freeman's (1997) prediction that complexity will be extremely influential in the field of EFL, therefore, the problem of finding an appropriate research method arises. A dynamic, open system cannot be described by isolating its components, or even by a more qualitative approach in which class participants reflect on their view of what takes place in that classroom. If we see everything in the classroom as interacting with everything else, if we see these connectivities as the most important things that occur there, if we do not expect to be able to predict local outcomes of linguistic input, if we see every language class as unique, if we are to include the interactions that occur outside the classroom (parent-student, peer-student, TV-student, pop-culture-student, parent-parent, parent-teacher, teacher-principal, principal-local government, etc.), if we are to build a full picture of the classroom system and if we are to describe the social, affective and cognitive structures which emerge from its connectivities, then we need a fully comprehensive research methodology.

The educational context, with the classroom at its center, is viewed as a complex system in which events do not occur in linear causal fashion, but in which a multitude of forces interact in complex, self-organizing ways, and create changes and patterns that are part

predictable, part unpredictable. Such changes must be analyzed from the bottom up.

(Van Lier, 1996, p. 148)

#### **IV. General Systems Theory**

General systems theory is a general science of “wholeness” (Bertalanffy, 1969, p. 37), in which the phrase “the whole is greater than the sum of the parts” means that overall (global) characteristics are not explainable from the characteristics of isolated parts, but appear as “new” or “emergent”.

A system can be defined as a set of elements standing in interrelations. Interrelation means that elements  $p$ , stand in relations,  $R$ , so that the behavior of and element  $p$  in  $R$  is different from its behavior in another relation,  $R'$ . If the behaviors in  $R$  and  $R'$  are not different, there is no interaction, and the elements behave independently with respect to the relations  $R$  and  $R'$ . (Bertalanffy, 1969, p. 55)

Although the whole cannot be predicted from its parts, it follows from this definition that the behavior of a system may be derived from the behavior of the parts, if their total and the relations between them is known. Thus modern systems theory offers a methodology for researching complex systems such as the language class, since it can provide a framework for investigating the interrelationship between all the complex elements and dynamic properties of socio-cultural systems. From this view, the essential factors in issues, policies, programs and personalities are considered and evaluated as interdependent components of a total system.

The concept of complexities, “wholes” and “systems” occurs in all fields of knowledge, with similar concepts, models and laws appearing in widely different fields independently and based upon totally different facts. Such isomorphism is one of the characteristics of general system theory, and indicates a universality of approach and a holistic view of the sciences. According to this view, the following observations can be made:

1. There is a general tendency towards integration in the various sciences, natural and social.
2. Such integration seems to be centered in a general theory of systems.
3. Such theory may be an important means for aiming at exact theory in the non-physical fields of science.
4. Developing unifying principles running “vertically” through the universe of the individual sciences, this theory brings us nearer to the goal of the unity of science.
5. This can lead to a much-needed integration in scientific education. (Bertalanffy, 1969, p. 38)

Such a holistic vision of the systems sciences contrasts with the atomistic and mechanistic worldview of the classical disciplines. The investigation of wholeness and of interactive connectivities promotes cooperation, sustainable development and diversity above competition and exclusion. Such a view matches well with modern student-centered approaches to language learning (see table 1, below).

Table 1: Contrasting world views of classical and system sciences (adapted from Laszlo, 2002, pp. 10-12).

<b>Worldview of classical sciences</b>	<b>Worldview of system sciences</b>
<ul style="list-style-type: none"> <li>● Nature is a giant machine composed of intricate but replaceable machine-like parts.</li> </ul>	<ul style="list-style-type: none"> <li>● Nature is an organism with a non-deterministic ability for choice, flow and spontaneity.</li> </ul>
<ul style="list-style-type: none"> <li>● Objects are to be observed separate from their environment. People are to be observed as separate from each other and their surroundings.</li> </ul>	<ul style="list-style-type: none"> <li>● Emphasizes connections between people and nature, community and integrity in the natural and human world.</li> </ul>
<ul style="list-style-type: none"> <li>● Materialistic: all things are measurable material entities.</li> </ul>	<ul style="list-style-type: none"> <li>● Matter is a configuration of energies that flow and interact, allowing for probabilistic processes, self-creativity and unpredictability.</li> </ul>
<ul style="list-style-type: none"> <li>● Promotion of power and competition.</li> </ul>	<ul style="list-style-type: none"> <li>● Importance of information, education, communication and human services.</li> </ul>
<ul style="list-style-type: none"> <li>● Increasing use (and waste) of energies, raw materials and other resources.</li> </ul>	<ul style="list-style-type: none"> <li>● Sustainable development through flexibility and accommodation among cooperative and interactive</li> </ul>

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<ul style="list-style-type: none"> <li>● Eurocentric: promotion of Western industrialized principles of progress and development.</li> <li>● Anthropocentric: human beings master and control nature for their own ends.</li> <li>● Struggle for survival, individual profit.</li> </ul>	<p>parts.</p> <ul style="list-style-type: none"> <li>● Diversity of human cultures and societies, all equally valid.</li> <li>● Humans as organic parts within a self-maintaining and self-evolving whole (life on this planet).</li> <li>● Cooperation, tolerance of diversity.</li> </ul>
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Having identified systems theory as a holistic, humanistic means of investigating the language class, the English teacher and the EFL researcher is still left with the problem of discovering and documenting common features of systems organisation in language learning. Luckily, it is not necessary to learn how to deal with differential equations and complex mathematical algorithms in order to employ systems theory as a research tool, since the systems concept can be seen as a “guiding idea” rather than a mathematical construct and is still valid even when it cannot be formulated mathematically. When considering this guiding idea with relation to the language classroom, a number of organizational invariances of natural systems can be taken into account:

1. *Natural systems are wholes which cannot be reduced to their component properties<sup>1</sup>.*

As language teachers will be aware from their experiences with group work in class, learners in small intimate groups behave differently than they do in large ones (the whole class). The properties of these small groups cannot, however, be explained simply in terms of the properties of the individual members. Each group shares characteristics specific to groups of the type to which it belongs and these characteristics can remain fixed even if all the individual members are replaced.

2. *Natural systems maintain themselves in a changing environment.*

Just as living organisms constantly take in and send out energy and information, the EFL class is in a continual state of change. In the long term the learners come and go, teachers move on to other positions, the learning syllabus changes, and pedagogic policies controlling course design are modified. In the short term, learning input is renewed and

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<sup>1</sup> These invariances are adapted here for the EFL situation, based on Laszlo, 2002, pp. 25-58.

assessed regularly, and new language activities generally appear in each lesson. Input and output are thus constantly replaced and maintained, even as the learning environment takes on different forms.

3. *Natural systems are self-organising and self-creating in response to other systems.*

When changing conditions are too drastic for local adjustments of the existing structure, natural systems evolve new structures and new functions, in phylogenesis. In the manner of the avalanche effect, processes in the language class can continue to build up until they reach a critical threshold; at which time they trigger sudden change. A groundswell of opinion about the inappropriateness of discrete-item, multiple choice, high-stakes testing (for example) might gradually compound itself, until the relevant system of inflexible organizations and administrators collapses, giving way to interdependence, complexity and differentiation, according to basic laws of evolutionary development. Poorly advised crisis management can thus be replaced by preventative self-transformation, as order emerges from chaos.

4. *Natural systems exhibit equifinality*

In any closed system, the final state is determined by the initial conditions, and order gradually tends to entropy. In open systems, however, the same final state may be reached from different initial conditions and in different ways. This property of equifinality is significant for the EFL class, since it allows for autonomy of learning and diversity of learning styles. If the global goal of the language class is communicative competence, then the concept of equifinality states that there are various equally valid ways of achieving that goal, and that the paths taken by self-directed learners (and the learning structures which emerge on the way) might not be predictable at the local level.

5. *Natural systems are coordinating interfaces in nature's holarchy.*

As already mentioned, the language class can be seen as a collection of systems within systems. Organisation in this complex situation takes the form of a holarchic pyramid, in which individual systems have the role of coordinating interfaces, liaising between the

closest systems. The function of each individual system is to coordinate the behavior of its own parts and to integrate this with the behavior of the other components in the system. From this perspective, the teacher can be seen as the interface between the students at a lower level of the pyramid and the learning institution (syllabus, regulations, assessment, etc.) at a higher level. Similarly, the principal of the institution interacts with the teacher (lower level) and educational policy makers (higher level). The learners themselves are a system interacting with the teacher (higher level) and their home environment (parents, culture, etc.).

## **V. Conclusion**

This paper has attempted to show that the EFL classroom can be seen as a natural system conforming to the general characteristics of “an open system in a steady state” This perspective allows teachers and researchers to view the various participants and all the connectivities that occur in the classroom as instances of organised complexity, gradually evolving in a self-organising manner. Such a socio-cultural, systems approach helps teachers to understand their roles in the classroom, as members of a holarchic pyramid of responsibilities and interactions, and provides a rationale for a humanistic view of education inherent in the systems world view.

In spite of the problems associated with researching the complexities of dynamically communicating subsystems (students, teachers, parents, syllabi, institutions, etc.) a systems view of the EFL classroom enables teachers and researchers to:

1. see the learning environment as a whole, with characteristics that are independent of its constituents and which can be maintained as the components change;
2. accept flexibility in teaching and autonomy in learning, allowing individuals to achieve the same educational ends through different methods (equifinality);
3. perceive education on the global and local level from a holistic, humanistic perspective;

4. see the EFL class as a process, in which seemingly insignificant events can build up to critical thresholds, sparking sudden, irreversible shifts and new structures (the avalanche effect).

In conclusion, it is recommended that a systems perspective of the EFL lesson be adopted by members of the EFL teaching profession, and that qualitative action research be carried out to determine the characteristics of interrelationships which occur in the foreign language classroom, so that positive contributory connectivities might be identified and counterproductive interrelationships documented. Such research projects would also investigate topics such as: i) characteristics of small group behavior in relation to other interfacing systems; ii) the learning environment as a self-creating and self-maintaining system; iii) the emergence and typology of new learning structures.

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## References

- Allwright, R.L. (1984). Why don't learners learn what teachers teach? The interaction hypothesis. In D. M. Singleton, & D. Little (Eds.). *Language learning in formal and informal Contexts*. Dublin: Irish Association for Applied Linguistics. 3-18.
- Bertalanffy, L. Van (1969). *General system Theory*. New York: George Brazillier.
- Brown, G. E. (1972). *Many-body problems*. North-Holland.
- Cotterall, S. (1999). Key variables in language learning: what do learners believe about them? *System* 27, 493-513.
- Horgan, J. (1996). Schroedinger's cation: Physicists prove that an atom can be in two different places at once. [Electronic version] *Scientific American*, June 17, 1996.
- Larsen-Freeman, D. (1997). Chaos/complexity science and second language acquisition. *Applied*

*Linguistics*, 18/2, 141-165.

Laszlo, E. (2002). *The systems view of the world: A holistic vision for our time*. Cresskill, N.J.: Hampton Press, Inc.

Lightbown, P. (2000). Anniversary article: Classroom SLA research and second language teaching. *Applied Linguistics*. 21/4; 431-462.

Stern, H.H. (1983). *Fundamental concepts of language teaching*, Oxford: Oxford University Press.

Stein Daniel L., ed. (1989). *Lectures in the Science of Complexity*. Reading MA: Addison Wesley,

1989Van Lier, L. (1996). *Interaction in the language curriculum: Awareness, autonomy, and authenticity*. London: Longman.

Waldrop, M. (1992). *Complexity: The emerging science at the edge of order and chaos*. New York: Simon and Schuster.

Widdowson, H.G. (1978). *Teaching language as communication*. Oxford: Oxford University Press.