

## COMPLEXITY AND SELF-ORGANIZATION IN ENGLISH LANGUAGE TEACHING/LEARNING SYSTEMS

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***Abstract:** As English has become the universal code for research across all fields of science, significant implications ensue as to the configuration of scientific language, meaning, and conceptual fundamentals shared among transdisciplinary researchers. The paper discusses several essential concepts employed in teaching ESP (English for Specific Purposes) from the perspective of the ecolinguistic approach to decoding the language of science. The major stake is promoting a creatively enhanced model of educational organization and mind-set. For this purpose, the discussion also considers the communicative potential of semiotics, with the aim of engaging ESP students' collaborative participation with content from their respective areas of interest within the Life and Natural sciences. The content-based analysis revolves essentially around the notion of complexity, embedded in a larger phenomenon pervasive in living systems at all levels – self-organization. These pivotal concepts are regarded from the standpoint of educational processes, but also in relation to the core scientific conceptual maps which students of ESP ought to become familiar with.*

***Keywords:** Ecolinguistics; ESP (English for Specific Purposes); complexity; self-organization; interdisciplinary research; ecological education, language learning.*

### **Introduction**

#### **1. Ecological learning models in English for Specific Purposes (the case of English for the Life and Natural Sciences)**

The fact that English language has become the medium of choice for academic networks at large in all fields of science carries substantive implications for the conjunction between the humanities and scientific language. This meeting point attains higher relevance especially from the point of view of paradigmatic approaches to decoding the language of science and as a framework for understanding significant vocabulary

acquired in ESP (English for Specific Purposes). The present study integrates the biosemiotic perspective with the educational mission we have as teachers of English for Specific Purposes applied to Ecological and Natural Sciences. Our students of English are majoring in areas related to the environmental sciences, ecology, agriculture, farm management, food engineering, biotechnologies, genetics, and others. Taking into consideration the consequence of conceptual enrichment and concept-based learning, the major aspects discussed in this paper revolve around meaning and complexity in education.

Traditional materialist scientific explanations of life processes and other reductionist views of complex systems have become gradually more incompatible with the non-linear nature of organization and interaction revealing itself throughout recent research across numerous areas of the life sciences. Against this background, the biosemiotic perspective (van Lier 2004; Gare, 2000) becomes relevant for the application of complexity and meaning to educational contexts. Furthermore, the biosemiotic glossary project is also a significant resource for common terminology employed in biosemiotic research and in material development for the purpose of ecolinguistics and language learning (Favareau & Gare, 2017).

The traditional strand of thought dominating Western civilization was committed to achieving complete technological control over nature (Polkinghorne, 2004:11). Along the same lines, the educational system tends to be stuck in reductive patterns in that science is too often taught as a secondary means for technological progress rather than for the purpose of uncovering the deep meanings of life and nature. On the other hand, ecological models oppose exploitation and dominion over nature and they regard self-organization as a higher principle in nature, which must be put into operation socially as well. These are also the principles that ecologically-minded educators endeavor to apply in their methodologies within the framework of human-centred education (Gill & Thomson, 2012), while recognizing the complexity of living systems and the self-organized potential of learning. Meaningful education occurs when students are doing the learning autonomously and become self-directed and genuinely interested in what they discover alongside the educator. Numerous disciplines have addressed these issues in what is now understood as Complex Systems theory, from ecology, biology and other life sciences to humanist psychology, sociology, cultural biology (cf. Humberto Maturana's philosophy of language, Bogusławska-Tafelska's (2013) ecology of language and communication, Jaak Jaak Panksepp's (2005) "affective neuroscience", etc). Alongside other emerging fields, these

transdisciplinary attempts are striving to map interconnections between all aspects of life processes from a holistic point of view, thus contributing to the emergence of an expanded scientific culture (Bogusławska-Tafelska, 2016).

### **Material and method**

Our interdisciplinary approach to decoding signifying systems in science language education resorts to semiotics and ecolinguistics, as well as conceptual analysis. The method we apply aims at engaging our students' collaborative potential in communicating significant meaning pertaining to their respective areas of interest within the Life and Natural sciences, which represents the material selected for ESP courses. The discussion revolves essentially around the notions of complexity and self-organization, which are regarded from the standpoint of educational processes, but also in relation to the core scientific conceptual maps targeted in the ESP language class. It is worth mentioning the ecolinguistics project and glossary put forward by Professor Arran Stubbe (2015) and the International Ecolinguistics Association, which has provided invaluable tools for the ESP courses and materials we have developed with the languages working team within the University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania" in Timisoara, Romania, the University of Tetovo, North Macedonia.

### **1. Optimal communication based on Conversation Theory**

The specificities of human interaction and optimal communication have been the object of intense interdisciplinary research for the last decades. This research draws on Pask's Conversation Theory (CT) theory (1975), which highlights the personal nature of reality and the process of learning as grounded on the consensual agreement of interacting participants in a particular environment, which is referred to as a "conversation". The conversational and dialogic underpinning provides an explanation of how social interaction leads to the dynamic construction of knowledge and meaning (Pask, 1975). Besides valuable descriptions of holistic and versatile learning styles, Pask (1976) also introduces the elements necessary for interaction to take place optimally: amity (availability for interaction), responsibility (able to respond to stimulus), unity (but not uniformity). These are required to produce agreement, but also "agreement-to-disagree" (relative independence) between interacting participants in the co-creation of meaning (Pask 1987:18). While agreements may be instances of "inter-subjective refinements of meaning"

(*ibid.*:19), our conceptualizations may also be widely divergent. As our personal concepts and viewpoints of something to which we attribute the same linguistic elements often differ extensively, we become aware of what Pask (*ibid.*:18) calls “enrichment by divergence” of our personal conceptions. The author also exemplifies synchronization between participants in conversational communication as commonality and coherence are reached amidst differences between participants, ultimately in their agreement to disagree. Despite individual perspectives, coordination of meanings and, thereby, effective communication takes place when participants in a conversation come to understand one another’s knowledge or difference. Therefore, Conversation Theory describes linguistic meaning as an emerging effect of interactive dialogue and the loophole cannot be completed without the listener who performs the selection of meaning, which must ultimately be shared.

More recently, cognitivist and mentalist interpretations have given way to a “newparadigmatic” understanding of the embodied explanation of human interactive dynamics, which is at the same time ecologically embedded (Bogusławska-Tafelska, 2019, forthcoming). Traditional cognitivist views of language which postulate the existence of a universal human socio-cognitive infrastructure are challenged by an understanding of interaction based on (i) the biology of cognition (Maturana, 1987); and (ii) the interfaces of the cognitive-noncognitive communication routes in living systems (Bogusławska-Tafelska, 2016).

Humberto Maturana and Francisco Varela (1980) put forth the theory of *autopoiesis*, meaning “self-(re)production” to refer to the individual’s self-organizing capacity and extended the concept from biology (cell formation through self-replication) to meaning systems. Endowed with interactional openness, any autopoietic system produces meaning not only in relation to the environment, but also in relation to the personal experience and participation of the actors involved in the construction of meaning. For Maturana (1987), any living organism displays an intrinsic property of “linguaging”, i.e. the capacity to perceive and communicate meaning in one form or another, thus achieving “operational coherences”. The cultural biology proposed by the author highlights that our sense of “humanness” is related to communication in awareness of ourselves and our environment, conversation, and “linguaging”. This refers essentially to the consensual coordination of meanings between human beings who are seen as “linguaging systems”, i.e. organisms who reflect and observe through language and who inhabit language systems. Along evolutionary lines, humans have evolved complex

communication systems in conjunction with the evolution of language, as “languaging” self-conscious beings (*ibid.* 1987).

The perspective of systems theory espoused by Maturana & Varela is further extended to the dimension of the socio-cultural space by Niklas Luhmann’s (1986) theory of autopoietic systems on the social plane, which is also grounded on the trans-disciplinary concept of *autopoiesis*. Central to the co-construction of a shared meaning structure is communication used by social systems as their typical mode of autopoietic reproduction (Luhmann 1986:178). A community of learners can be seen as a type of complex social system in which the learners themselves are co-creators of meaning and communication is further expanded into new networks of communication, which generates a feedback loop process (*ibid.*:174).

Thus, the role of self-organization in the class relies on natural synchronization in the mutual process of cooperation and feedback interplay. As students manage affective resources collectively, they also negotiate meanings in order to achieve dialogue in commonly accepted terms. Communicative collectivities may be seen as complex systems in which interdependent participants manage their differences through collaborative interplay. The “collective” phase in which learners regulate their own meaning and affective processes in tune with the others helps them organize themselves into a body of learners which is also a community working to achieve a common goal – in our case, educational success. Current research in ecolinguistics plays upon these aspects with respect to the co-creation of meaning, with an aim at promoting optimized models of communication within ecological learning systems (Bogusławska-Tafelska, 2016; Bogusławska-Tafelska, 2013; Coroama, Dragoescu Urlica, Groszler & Lungu, 2018; Dragoescu Urlica & Stefanović, 2018). Ecolinguistic models of communication go in the direction of transcending the mainstream cognitive-social perspective in research and teaching practice, to include other layers of intrasystemic and intersystemic communicational activeness of living systems, layers and mechanisms which are not social or neurocognitive *per se* (Bogusławska-Tafelska, 2013; 2016).

## **2. Self-organization in Complex Communicative Systems**

As elaborated by Harri-Augstein and Thomas (1991), Conversation Theory is centred on “self-organized learning”, which is coupled with assistance from teachers who help students “learn-how-to-learn”. For this purpose, the authors encourage “learning conversation” which, besides the topic itself and reflecting on learner experience, also includes conversation about the purpose of learning, encouraging the association of personal

involvement and commonly assumed responsibility in this on-going progression (Harri-Augstein & Thomas, 1991). As learning progresses, the body of knowledge is enriched by reiterating, reminiscing, and connecting topics with others which have been introduced previously. The conversational domain is thus modeled as an entanglement of topics and interrelated discussions, where students find their way and perceive connections by searching for coherent, global messages. Moreover, instead of instructing learners to submit to permanent constraints upon their own system of learning (*e.g.* oppressive listening to the teacher, aggressive error-correction, *etc.*), teachers become aware of affective factors which they do not inhibit. The theory of Self-organized learning also questions whether the teacher is really the ultimate “expert” or whether there is a single “best method” of teaching, irrespective of the actual group of learners in a particular context (Harri-Augstein & Thomas, 1991). This “deconstruction” of the expert position may help promote the educational process as an open-ended process, in which learners are involved in their self-development and self-education.

The ecological perspective on learning puts forward explorations of “the deep script of human interaction with the learning process, not in isolation, but within the broader context of students” concerns, attitudes and perceptions” as dynamically interconnected vectors which condition language acquisition (Tudor, 2003:10). Tudor (*ibid.*) proposes “a rethinking of the bases of pedagogical decision making” by taking into consideration a multiplicity of factors which make up the complexity of human learning and teaching. This includes affective and cognitive aspects which should be considered in continuity rather than in isolation, as interconnected dynamic vectors at the very basis of language acquisition. Thus, a class as a self-organized ecosystem displays the emergent qualities of a whole being constituted by parts functioning together in synchrony, while “being in relationship to” and being self-organized to achieve a common purpose – such as education – which essentially depends on the individual partakers of this process. Thus, classes of ESP are organized according to a type of dynamics which is reconsidered as a holistic self-organized system. This learning environment encourages spontaneity, creativity, and free speech, while focusing on the specific communicative needs expressed by each respective learning community at a specific time and ultimately leading to “the co-creation of the community” from within (Coroama, 2018:196-197).

This perspective on the integrative co-creation of meaning takes us, finally, to a discussion of self-organization in complex systems such as a biological or the social-semiotic system which may be a community of

learners. From an ecological perspective, van Lier operationalized second language acquisition as a prototype of a complex system in nature, where the environment does not simply provide input for passive recipients, but develops “effective ways of dealing with the world and its meanings” (van Lier 2000: 246). The context has a given “semiotic budget (analogous to the energy budget of an ecosystem) within which the active learner engages in meaning making activities together with others” (van Lier 2000:252). Furthermore, we may question how we learn and especially how we learn to communicate by looking out for meanings. In a human ecology of leaning, it appears as a matter of survival whether or not we find and relate meanings in otherwise non-meaningful events. For instance, it was not enough for our ancestors to perceive that an animal was approaching them, which may be a meaningless event in itself. Only by conceptualizing and assimilating notions such as “fierceness”, “pray”, “danger”, and through attaching context-relevant meaning to them, were our ancestors able to adapt for meaning as a survival mechanism. Therefore, only those who adapted to develop and relate to meaning were able to carry on their genes. Humans eventually ended up sharing such “consensual domains” which have meaning for us in certain contexts, to learn from experience and to teach others. Such systems based on collaborative or “consensual domains” are considered language oriented systems (Pask, 1973) and cannot be conceptualized outside meaning (*cf.* Dragoescu Urlica, 2018). For these reasons, in language education and beyond, meaning is perceived as relational and it is optimally constructed dialogically, through collaborative communication and by enabling unstructured affective input from individual students.

### **3. Conclusions**

Research on language acquisition regarded as a self-organized complex system (van Lier, 2000) has had sweeping and profound consequences upon the emergence of an ecological paradigm in education. Self-organization is also referred to as “spontaneous order”, especially in the social sciences, which is regarded as a process where overall order emerges out of local interactions between chaotic or disorderly parts of a system. Such processes are largely decentralized and do not need planning or directed control from the outside, but are generated naturally through positive feedback. A consequence of such a type of organization is its capacity of being naturally robust (Taleb, 2012:3-5) and having higher chances of survival or self-repair potential upon perturbation. Self-organization occurs in many physical, biological, social, and cognitive

systems, ranging from neural networks and crystal formation to animal group behaviour like swarming, *etc.*

If a community of learners is considered a complex living system and compared against Taleb's description of antifragile organizations, there are several features which can be corroborated: living organisms are complex adaptive systems which, despite randomness, generate self-repair and exhibit a high degree of interdependence (*ibid.*:67). Unlike mechanical systems, where stressful agents cause material fatigue, absence of stressors causes atrophy in organic complex systems. This may be seen in correlation to affective stressors during communication processes and as emergent phenomena perceived as challenging self-structure (as conjured by the "political correctness" cultural paradigm). It may be hypothesised that we can become less fragile by allowing ourselves to be exposed to such challenges more fluidly, knowing that we do not lose, but are in a position to gain from occurrences such as different/divergent points of view. These should not be perceived as a threat to our being (which may arguably be a major cause of conflict in everyday encounters), but merely a menace to static meanings/narratives that we have taken up as defining for ourselves, i.e. limiting us from further development throughout lifelong learning. Only thus can we evade the paradox of freedom which has become the intolerance of intolerance, among other socio-cultural traps.

There is also a case to be made that the degree of connectivity within a system depends on the propensity towards collaborating with peers and perceptive awareness without feeling threatened by others from an emotional point of view. Another offshoot of this line of thought would question didactic pre-organization in the absence of students and without taking into consideration their collaborative input. In analogy to central planning which renders economic systems less effective than spontaneous order occurring organically on a healthy market, didactic over-planning enforces rigid, preconceived patterns which hinder complexity in the actual community of learners (*cf.* Taleb 2012:145). It also disregards affective components at play in a large range of variants, depending on the given group of students. These aspects should be allowed to evolve spontaneously in the classroom – which will be different every single time. This didactic critical view of over-planning may also be corroborated with the psychological approach put forth by Schneider-Landolf, Spielmann, & Zitterbart (2017).

The paper has performed a conceptual transfer of fundamental notions in the Life and Natural sciences (complexity and self-organization) to the area of ESP learning and teaching, hoping to find optimized and more

ecologically-embedded ways of educating students for communicative purposes. The construction of personally relevant meaning was targeted by drawing on Conversation theory and Self-organized learning, which promote a foundational model for the construction of collaborative communication based on shared understandings among students. This is a step forward from the constructivist language learning framework extended to a social semiotic environment, which we also propose as a working model for ESP courses. As we have seen, students engage in language learning and become genuinely responsive when they perceive meaning structures, *i.e.* what makes sense to them in a highly contextualized educational experience. In as much as ESP classes create a suitable environment for immersing learners in real communication to better perceive and understand the complexity of living and natural systems, the opportunities set out for class interaction trigger higher levels of response and collaboration. In conclusion, we must take shared responsibility in ESP learning/teaching, given the fact that linguistic educational practices have profound effects on the way learners conceptualize communication, decode meaning and enhance their learning potential.

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