The Relevance of Systematicity to Chaos Complexity Theory

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Abstract–It is alleged that linguistic development is governed by some systematicity which is available to many second language acquirers. Scholars hold that linguistic capacities are systematic. Some state that systematicity exists in the first and second language acquisition. However, this systematicity is affected by some chaotic behaviors. The present article endeavors to investigate the issues of systematicity and chaos and depicts the critical views to the systematicity and chaos in language development.

Keywords – Systematicity; Chaos; Chaotic behavior; First Language Acquisition; Second Language Acquisition; Emergentism.

Systematicity

To understand more the concept of systematicity, it is better to review some definitions of systematicity. Following Towell and Hawkins [19], systematicity in language is defined as the linguistic development which is common to many L2 learners. They hold that speakers of several different first languages such as Italian, Spanish, Portuguese and Turkish seem to go through a series of stages in moving towards the target language. Along the same line, Robbins [18] holds that systematicity is something of a commonplace that linguistic capacities are systematic: very roughly, that understanding a sentence entails understanding certain other sentences related to the first. Likewise, it is something of a commonplace that the best way to account for this fact is by supposing that linguistic meaning is compositional: again roughly, that to understand a sentence, it suffices that one understands the meanings of the words it contains and its syntactic structure.

Van Patten and Benati [20] state that "systematicity refers to behavior in which learners perform consistently with a particular form or structure. For systematic behavior to occur, the learner does not have to be accurate; the learner just has to be consistent. So, for example, if a learner is in the early stages of the acquisition of negation and consistently produces structures of the type no + X (e.g., *no drink water*, *no want go*, *no like soup*), we would say that behavior is systematic. Systematicity stands in contrast to variability/variation, in which learner behavior with a particular form or structure is not consistent" (p.157).

There have been some discussions concerning the notion of systematicity from the chaos perspective. It can be stated that much of the discussion of systematicity has spotlighted the question of whether and how connectionists are able to explain the systematicity of cognitive capacities without simply implementing a classical architecture. That is to say, the debate has focused on whether connectionist systems offer a genuinely novel way to understand the empirical phenomenon of systematicity. Of course, discussions of systematicity have not been limited to the connectionism/classicism debate. Systematicity has also been discussed frequently in other areas of the philosophy of mind ([6], [5], [17]). Johnson [9] states that claims about systematicity, especially the systematicity of language, are typically taken to be trivially true and Matthews [16] stated that human beings' capacity for natural language is systematic.

Cummins [1] points out that the systematicity of language is relatively unproblematic. Fodor and Pylyshyn [6] hold that linguistic capacity is a paradigm of systematic cognition. Johnson [9] states that "the nature of systematicity is rarely more than cursorily sketched: an example or two is typically thought to characterize the phenomenon adequately. In short, the prevailing optimism of the literature suggests that everybody knows what systematicity is and that language, and probably thought too, clearly has it" (p. 112). Elsewhere, Johnson [9]

expresses his doubt about systematicity and states that it is not very clear what systematicity is and it is uncertain that language or thought has systematicity.

Systematicity of Language

Johnson [9] alleges that "natural languages are not systematic and more importantly, this way of thinking of systematicity depends on a crucial but inaccurate assumption about the nature of linguistic natural kinds. When this assumption is corrected, it becomes utterly mysterious what it even means to say that natural language is systematic. Although the primary goal is to explore the nature of the systematicity of language as such, this exploration has consequences for the systematicity of thought and for the role that systematicity plays in the connectionism/classicism debate. The systematicity of thought suffers from problems analogous to the systematicity of language, and it does not appear to play any interesting role in the debates about cognitive architecture" (p.112). Johnson's view of systematicity is maximally pessimistic. That is, systematicity does not exist. He keeps on claiming that if it did, languages would not have it and if it existed and languages had it, systematicity still would not be interesting to many of the debates in which it has some parts.

Cummins [1] takes a different look at the notion of systematicity. He states that "a system is said to exhibit systematicity if, whenever it can process a sentence, it can process systematic variants of, where systematic variation is understood in terms of permuting constituents or (more strongly) substituting constituents of the same grammatical category" (p. 594).

Johnson [9] adopts a version of Cummins's [1] characterization, with a couple of minor qualifications. He speaks about whether a sentence is grammatical or not instead of speaking about a system processing sentences. He does so in that he wants to focus on whether language is systematic, and our linguistic abilities may be distinct from our abilities to process language. To clarify the point, he says "although speakers reject the sentence *the child seems sleeping* as ungrammatical, there is also a sense in which it has a clear meaning, and might be thought to be processible, in some extended sense of the word. Indeed, utterances like *him give she cookie now!* and *take and slab!* might also be processible, too. I wish to treat all these examples as falling outside of natural language or at least outside of English, which is the natural language" (p.113).

Systematicity and Chaos

Grounded upon the aforementioned ideas concerning the systematicity of language, it can be stated that language is systematic and complex, consisting of many different subsystems: phonology, morphology, lexicon, syntax, semantics, pragmatics and these subsystems are interdependent. Thus, it should be stated that a change in any one of them can result in a change in the others ([11], [12], [13], [14]). But our abilities to process language are different from our linguistic abilities. This refers to the fact that the abilities to process language are chaotic in relation to our linguistic abilities. Therefore, there is some order and disorder [15]. Also, it should be stated that these systems are complex, thus comprising a large number of components or agents [2]. Along the same line, Waldrop [21] mentioned that the behavior of complex systems is more than a product of the behavior of its individual components. While rules can be used to describe such systems, the systems themselves are not the product of rules [15]. In other words, the behavior of the whole emerges as result of the interaction of the subsystems with the chaotic manner of our abilities to process language. Larsen-Freeman [15] also stated that "complex nonlinear systems exhibit sensitive dependence on their initial conditions, and language is no exception" (p.149).

Non-Chaotic Systematicity: An Emergentist View

Ellis [4] holds that language is a dynamic system, comprising of the ecological interactions of many players. It operates across many different agents (neurons, brains, and bodies; phonemes, morphemes, lexemes, constructions, interactions, and discourses), different human conglomerations (individuals social groups, networks, and cultures), and different timescales (evolutionary, diachronic, epigenetic, neurosynchronic, interactional, ontogenetic). Cognition, consciousness, experience, embodiment, brain, self, communication and human interaction, society, culture, and history are all inextricably intertwined in rich, complex, and dynamic ways in language. He further points to the fact that despite this complexity and systematicity, despite its lack of overt government, instead of anarchy and chaos, there are patterns everywhere, patterns not preordained by God, by genes, by school curriculum, or by other human policy, but patterns that emerge, synchronic patterns of linguistic organization at numerous levels (phonology, lexis, syntax, semantics, pragmatics, discourse, genre, etc.), dynamic patterns of usage, diachronic patterns of language change. As a complex system, the systematicities of language are emergent and adaptive. Only by adopting an integrative, dynamic framework will we understand how they come about. Language learning and language use are dynamic processes in which regularities and systems arise from the interaction of people, brains, selves, societies, and cultures using languages in the world.

Conclusion

Attempts were made to scrutinize the notion of systematicity in relation to chaos theory. It is claimed that language is systematic and complex, consisting of many different subsystems which are interdependent (e.g. [14]).

Johnson [9] alleges that our abilities to process language are chaotic in relation to our linguistic abilities. Yet, there are some scholars who investigate language systematicity from dynamic systems ([3], [7]), complex systems ([8], [10]), and emergentism (Ellis, 2008). But Ellis is of the contention that this systematicity lacks chaotic behavior.

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Vitae

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