Revitalization of Emergentism in SLA: A Panacea!

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Abstract

Emergentists claim learning takes place by extracting regularities from the input. By the same token, Ellis (1998) disputed the view held by generative linguistics that such a complex phenomenon as language can only be learnt if it is assumed that humans are endowed genetically with a language specific learning device. Emergentists, as O'Grady (2003) reports, claim simple learning mechanisms are sufficient to bring about the emergence of complex language representations. Nevertheless, this perspective toward learning has so far failed to take into account how language competence could emerge (O'Grady, 2003). The following paper is an attempt to elucidate the theoretical assumptions behind emergentism.

Key words: emergentism, reductionism, unpredictability

1. Introduction

There is less of consensus as to exactly what emergentism itself claims about the working of language (O'Grady, 2008). As Stephan (1997) observes, an immense variety of emergentist doctrines can be identified, and the resulting theories have many faces. To better appreciate the notion of emergentism, let me first, briefly draw a distinction between property theory and transition theory. Psycholinguistically, the property theory is concerned with such a question as what is the nature of a given faculty?, while in the transition theory, we tend to answer how do we acquire that faculty? Emergentism is clearer on the transition theory than the property theory. In effect, to an emergentist, language is acquired through associative learning (Gregg, 2003). Thus, claiming that emergentism by nature is non-linguistic rather than linguistic is undisputable. By the same token, O'Grady (2003) argues a substantial portion of emergentist work seems to involve a commitment to the following thesis: the phenomena of language are best explained by reference to more basic non-linguistic (i.e., "non-grammatical") factors and their interaction (p. 274). As said earlier, learning in this view occurs on the basis of associative process, rather than the construction of abstract rules (Mitchel & Myles, 2004). According to Mitchel and Myles (2004), "the human mind is predisposed to look for associations between elements and create neural links between them" (p. 127). As they hold, "these links become stronger as these associations keep recurring, and they also become part of larger networks as connections between elements become more numerous" (p. 127). In a nutshell, emergentism is a leading theory of language acquisition that declares language ability is the product of interactions between language environment and one's learning capabilities.

2. Literature Review

Emergentism is the name that has recently been given to a general approach to cognition that stresses the interaction between organism and environment and that denies the existence of predetermined, domain specific faculties or capacities (Gregg, 2003). It seems emergentists give an equal value to both organism and environment in the process of learning. Not like behaviorists, in an extreme form, who ignore the role of organism and cognitivists, in contrast, who give the primary role to the organism in the process of language acquisition.

Emergentism offers itself as an alternative to modular, special nativist theories of the mind, including Universal Grammar (Ghaemi & Faraji, 2011). Along the same line, O'Grady (2010) argues that emergenist approaches to language necessarily stand in opposition to theories of the language faculty that posit an innate universal Grammar. In short, emergentism is in contrast with Chomskyan approaches which see language as a separate faculty from other cognitive functions. In effect, emergentists assume that generic associative learning mechanisms underpin all aspects of language acquisition (Ellis, 2003). Put another way, emergentism is radically different from both generativist and interactionist epistemologies. Norris and Ortega (2003) hold:

on the one hand, it is incompatible with generative SLA because it denies symbolism, modularity, and innatism, and it removes linguistics from the center of the research domain, replacing it with cognitive architecture. On the other hand, in spite of the shared interest in functionalist explanations and cognitive constructs, emergentist theory resonates little with interactionist SLA. The highly specialized neurobiological treatment of cognitive processes, the lack of a traditional dichotomy between representation and access, and the absence of interest in non-cognitive variables (social, affective, educational, etc.) all differentiate emergentist from interactionist perspectives. (p. 724)

2.1 Theoretical background

The roots of emergentism can be traced back to the work of John Stuart Mill (1930) who took an anti-reductionist perspective toward a system. To him, a system can have properties that amount to more than the sum of its parts. By the same token, Van Lier (2004) holds 'non-reductive' means that the lower-level categories cannot explain the higher-level ones; they are radically different, although the higher level is based on and built up from the lower level element. John Stuart Mill was among the first who makes a distinction between mechanical causes and chemical causes. In chemical processes the mixture of several elements not only leads to the products which are not the sum of the mentioned elements, but also looks something completely different (Jalilzadeh, 2011). It can be claimed the chemical combination of two substances produces a third substance with properties different from those of either of the two substances separately, or both of them taken together (O'Grady, 2010).

Roughly speaking, it is a family of views each holding that there are "new levels" of concrete particulars that emerge when we combine more simple components. That is, emergentism holds that there are "wholes" in the world that have properties/causal powers or "natures" that are not possessed by the parts that give rise to them.

2.2 Principles underlying emergentism

The technical meaning of the word emergentism can be traced to such features as novelty, reducibility, and unpredictability (Stephan, 2006). The basic idea of emergentism according to Stephan (2006) is: as systems become increasingly complex during evolution, some of which may exhibit novel properties that are neither predictable nor explainable. Thus, as Stephan (2006) maintains complex wholes can come to have properties that are not reducible to the properties and relations of their constituents. Meanwhile, the concept of emergentism in linguistics also holds that language is a machine built out of old parts (Bates & MacWhinney, 1988, cited in O'Grady, 2010). Along the same line, O'Grady (2010) asserts that there is no general agreement concerning just what those parts might be, ranging from features of physiology and perception, to processing and working memory, to pragmatics and social interaction, to properties of the input and of the learning mechanisms.

Emergentists claim learning takes place by extracting regularities from the input. In fact, having sufficient and effective input is a demand for learning to emerge. By the same token, Bot, Lowie and Verspoor (2000) also assert emergentism depends to a great degree on input. They say only when children have become very familiar with a few similar constructions will they generalize from these to new ones (p. 38).

Elsewhere, O'Grady (2008) assert although linguistic emergentism denies the existence of certain types of grammatical principles, it does not deny the existence of grammatical properties (p. 448). According to him, the properties of grammatical phenomena arise from the interaction of factors that are not linguistic (O'Grady, 2007). Along the same line, this view is completely against the Universal Grammar view, which stresses on the importance of grammatical principles; the followers of this view believe that the properties of grammatical phenomena arise from the interaction of grammatical principles. In other words, the relationship between grammatical principles and properties are in cause and effect nature, not an emergent. According to O'Grady (2007), such anti-UG attempt known as emergentism tries to solve the question of language acquisition. Hence, emergentism is a cognitive approach that puts an emphasis on the interaction between organism and the environment and rejects the notion of having pre-determined capacities (Ziglari, 2008).

2.3 Types of emergentism

To better appreciate the notion of emergentism, let's refer to a distinction between two perspectives concerning emergentism proposed by Gregg, 2005 – a nativist perspective and an empericist perspective. Although both groups stand against pure nativism or what Fodor (1984) named as 'mad dog nativism' (p. 153), their theoretical perspective are somewhat different. As a pioneer in nativist empiricism, O'Grady believes in nativism but without universal grammar (Jalilzadeh, 2011). On a word, children are born with LAD which does not include any principles. In fact, the entire grammar is the outcome of interaction of acquisition device and experience. And as to

O'Grady (2003), "…, no grammatical knowledge is inborn" (p. 44). Empiricist emergentists–notably Nick Ellis–study language acquisition in the form of neural networks. Empericist emergentism, in contrast with nativist emergentism, is related to connectionism: an approach to the study of the mind that seeks to model learning and cognition in terms of networks of (assumedly) neuron-like units. In this view, that is empiricist emergentism, language is neither a genetic endowment nor a collection of static rules and forms to be acquired. In fact, language is the result of communicative processes (Jalilzadeh, 2011, p. 153), and as Ellis (1998) argues, language representations emerge from interactions at all levels from brain to society. Thus, according to empiricist emergentists, the meticulous description of language systematicities provided by Chomsky, though precious, is not sufficient because they do not explain how learners achieve the state of knowledge that can be described in this way (Ellis, 2005).

To date, emergentist work within linguistics has focused most strongly on the question of how language is acquired. Jalilzadeh(2011) in a comparison between empiricist emergentism and nativist emergentism concludes that the former claims language learning is not fundamentally different from any other type of learning and can be learned by the same the same mechanisms used for other kinds of learning in interaction with the environment in general, while the other view, nativist emergentism, argues that language learning differs from the ways connectionist views offer. Nativist emergentists believe in an inborn acquisition device dedicated to language, but they do not agree the grammatical character of this inborn device.

Another classification of emergentism that will help us to better understand the theoretical thoughts behind is Stephan's (2003): weak, synchronic and diachronic emergentism. Weak emergentism, according to Stephan (1999) has the following characteristics: (1) *physical monism* (i.e., all entities in the world are composed of physical elements); (2) *systemic properties*. (i.e. a property of a system is systemic if none of the components of the system has it; and (3) *synchronic determinism* (i.e., the properties of a system are nomologically dependent on its microstructure). In fact, weak emergentism is perfectly compatible with reductive physicalism (Eronen, 2004). As to Stephan (1999), reductive physicalism need not deny the existence of systemic properties, and physical monism and synchronic determinism should be accepted by all naturalistically oriented philosophers.

Synchronic emergentism is weak emergentism supplemented with irreducibility (Stephan, 1999, p. 68). According to Stephan (1999), the notion of irreducibility can be divided into two parts: (a) if they are not behaviorally analyzable, or (b) if the behavior of the components over which they supervene is irreducible. In both cases the systemic properties cannot be deduced from the behavior and properties that the components show in isolation or in simpler systems (p. 43).

Diachronic emergentism is also weak emergentism supplemented with the characteristics *novelty* and *unpredictability* (Stephan 1999, p. 69). According to Eronen (2004), in the history of emergentism, this form is more prevailing than synchronic emergentism, but for philosophy of mind it is of little interest (p. 40). Diachronic emergentism is mainly interested in the *predictability* of novel properties. For such a theory, those properties are emergent that could not have been predicted in principle before their first instantiation (Stephan, 2002). To sum up, the difference between weak and diachronic emergence is the unpredictability of properties. The difference between diachronic and synchronic emergence is the irreducibility of properties. Moreover, if one property or entity has not existed before and suddenly comes into existence, it means that the property or entity is diachronically new. Synchronic novelty is time independent (Scholz, 2004, p. 2). These two kinds of irreducibility produce either *downward causation* or *epiphenomenalism*. Downward causation can be defined as a converse of the reductionist principle: the behavior of the parts (down) is determined by the behavior of the whole (up), so determination moves downward instead of upward. The difference is that determination is not complete. This makes it possible to formulate a clear systemic stance, without lapsing into either the extremes of reductionism or of holism (Campbell, 1990). Epiphenomenalism is the view that mental events are caused by physical events in the brain, but have no effects upon any physical events. Behavior is caused by muscles that contract upon receiving neural impulses, and neural impulses are generated by input from other neurons or from sense organs (Robinson, 2003).

To have a broad look at the notion of emergentism, one can also investigate the strategies that emergentists employ. Along the same line, O'Grady, Lee, and Kwak (009) hold, depending on the dominant strategies that emergentist approach adopts, they can be divided into two types: *input-based* as advocated by Nick Ellis and *processor-based* supported by O'Grady (1999). The former, focuses on the effect of frequency of certain items in the input and acquisition, while the latter, processor-based emergentism, focuses on the cognitive processing of language, offering a solution to the poverty of the stimulus problem different from the UG approach. O'Grady prefers processor to input. The defining property of his processor is its commitment to reducing the burden on the

working memory. Yang (2009) in an interview with O'Grady reports that he further claims processor is efficiency-driven. Meanwhile, the processor adopts particular strategies, such as backtrapping—going back and changing the interpretation of a previously interpreted element. Along the same line, these processors are innate. O'Grady claims when he says that the 'processor' or 'working memory' is innate, he is actually talking about very general operations and propensities—not about anything specially linguistic or grammatical (p. 423).

2.4 Connectionism

Connectionism as a model of emergentism is defined as a theory in cognitive science that assumes that the individual components of human cognition are highly interactive and that knowledge of events, concepts and language is represented diffusely in the cognitive system (Richards & Schmidt, 2002, p. 108). According to Mitchel and Myles (2007), "language in this view is seen as a set of probabilistic patterns that become strengthened in the brain of the learner through repeated activation" (p. 127).

The basic assumptions of the connectionist theory, according to Richards and Schmidt (2002), are as follows:

> 1. Information processing takes place through the interactions of a large number of simple units, organized into networks and operating in parallel.
>
> 2. Learning takes place through the strengthening and weakening of the interconnections in a particular network in response to examples encountered in the input.
>
> 3. The result of learning is often a network of simple units that acts as though it "knows" abstract rules, although the rules themselves exist only in the form of association strengths distributed across the entire network. (p. 108)

Ahlsén (2006, as cited in Ghaemi & Faraji, 2011, p. 45) called connectionism as associationism. By the same token Ghaemi & Faraji report that he asserts higher functions are dependent on the connections between different centers in the cortex; furthermore, linguistic ability is seen as the relationship between images and words. Ahlsen (2006) also believed that aphasia results from broken connections between the centers that are needed for linguistic function.

Connectionism is an approach in cognitive science that employs neural networks. This neural network, or connectionist system, is composed of a set of nodes or units, so-called activation vectors. Units in a net are usually segregated into three classes: input units, which receive information to be processed, output units where the results of the processing are found, and units in between called hidden units. According to Ghaemi and Faraji (2011), "The effectiveness of this learning process has been increased by a feedback mechanism known as back propagation which provides the program with a kind of memory. Ghaemi and Faraji (2011) also hold by dint of many repeated presentations of the input, some connections within the network become strengthened while others become weakened. In this way, the network can gradually be trained to produce to correct responses through a process of error reduction (Field, 2004, cited in Ghaemi & Faraji, 2011, p. 46).

Connectionist learning

For learning to occur, these units (i.e., input, hidden, and output) must be activated and the activation must be propagated. Furthermore, based on the experience gained what is connected must be modified in order to be learned. To connectionists, learning is *adjusting the strength of connection* so that a given input results in a desired output. They emphasized learning occurs when an organism discovers a difference between the state of the world and the organism's representation of the world. In effect, all that is needed for learning is having two nodes simultaneously activated. The less the difference between input and output, the stronger and the faster learning will be. For example, first, the child might say *'goed'* for *'went'*, but he works out the rule system and begin to produce both regular and irregular verb formed correctly. How does this happen? To connectionists (although not that much simple that I put), the brain creates networks which connect words or phrases to other words or phrases which occur at the same time. This connection will be strengthened if learners are repeatedly exposed to linguistic stimuli in specific context. For example, when one says *'I go'* and *'she goes',* the latter is thought to be established through high-frequency exposure, the word *'she'* triggers *'goes'* because the learner has heard these forms in combinations many times.

Connectionism forms an important nonlinguistic approach to studying language acquisition that has important ties with psychology and general learning (Patten & Benati, 2010, p. 75) In a nutshell, Patten and Benati (2010) hold:

> Connectionism is an exemplar-based approach, meaning that learning occurs due to the examples we are exposed to in the input. From these numerous examples, patterns and

regularities emerge to form what looks on the surface to be knowledge—or in the case of language, rules. (p. 76)

To better appreciate the concept of exemplar-based approach, take the following example. If the speaker of English hears the sound /flaur/ (maybe *flower* and *flour)* as an isolated word, the first word that pops into the speaker's mind is the word 'flower'. Why does flower come to mind first? The connectionist would say that *'flower'* is much more frequent than *'flour'*. Thus, frequency of exemplar in the input plays a major role in learning (strength building) under connectionism. Grammar, also, in language, under a connectionist account, does not form a mental representation with abstract concepts as it would for the syntactician. Instead, grammar is the result of constructions being learned (Patten & Benati, 2010). Accordingly:

> Constructions are units of form-meaning mappings and can be simple such as "Great!" or longer such as "How's it goin'?" These units exist as chunks that the speaker draws upon without creating sentences. However, smaller constructions can be combined to make sentences such that something like "I wanna" can combine with another set of units to form "I wanna go with you." (Patten & Benati, 2010, p.76)

Within SLA, connectionists have also challenged the notion of an innate knowledge source that is language specific (e.g., Universal Grammar). Gasser (1990) claims, "Universal Grammar (UG) is not compatible with the connectionist framework" (p. 188). The principles and parameters of the UG of Government and Binding (GB) theory, for example, are stated in terms of variables. In connectionism (or emergentism), the properties of language are best understood in terms of the interaction of more basic, nonlinguistic forces.

3. Conclusion

Many philosophers associate emergentism with a philosophical doctrine which had its heydays in 1920s: positivistic reductionism. Nevertheless, few are interested in emergentism as it is inspired by positivistic reductionism, and as Brown (2007) declares emergentism "oddly hearkens back to the spirit of behavioral approaches" (p. 32). Furthermore, it is guessed the probable collapse of emergentism may be once due to such philosophy behind. Above all, emergentism is an approach to describe and predict the complexity in the study of language learning. Importantly, emergentism attempts to minimize hypothetical universals so that the full diversity of languages and cultures can be understood rather than being obscured by exogenous constructs (Mellow, 2010). Thus, the root of it can be linked to Jean Piaget whose theory of development emphasized the interaction between experience and general cognitive mechanisms (O'Grady, 2008). Furthermore, emergentism in favor of simplicity in theory construction takes Occam's Razor principle. Occam's Razor requires that theorists use the most economical system of constructs to explain phenomena. Accordingly, much contemporary emergentist research remains committed to the idea that language acquisition can be reduced to the use of simple learning mechanisms to extract statistical regularities present in ordinary linguistic input.

Ellis (1999) cited in Jordon (2004) that emergentists believe that the complexity of language emerges from relatively simple developmental processes being exposed to a massive and complex environment. The Competition Model is a good example of an emergentist approach, rejecting, as it does, the nativist UG account of language, and the nativist assumption that human beings are born with linguistic knowledge and a special language learning mechanism. In the same line, emergentism claims that complex systems exhibit 'higher-level' properties that are neither explainable, nor predictable from 'lower-level' physical properties, while they nevertheless have causal and hence explanatory efficacy (Jordon, 2004, p. 246).

Roughly speaking, as O'Grady (2008) holds, there is currently no comprehensive emergentist theory of language or its acquisition, but there is a well-defined emergentist program for the investigation of those phenomena. That program is based on the simple thesis that the core properties of language are best understood with reference to more fundamental non-linguistic (i.e., 'non-grammatical') factors and their interaction. The viability of this idea can and must be measured against its success in confronting the classic problems of linguistic analysis—figuring out how language works and how it is acquired.

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