Emergentism

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1. Introduction

At the beginning of the semester, as we began diving into the many language acquisition theories that have arisen over the years, I found myself interested in Universal Grammar (UG) and the Nativist approach. But more than the content of the theory, I was dazzled by the sheer impact of Noam Chomsky himself, and his ability to meld science and philosophy in a novel way that was strong enough not only to stand up to the ruling Behaviorist claims of the time, but also lay such a strong logical groundwork that to this day UG remains one of the most influential theories in the field of applied linguistics. However, many axioms upon which UG is built stuck out to me like thorns, such as Chomsky's insistence that language must arise from some *innate* biological programming, and his expressed desires to abstract language away from real-life production and towards perfect "competence" and the speaker into an "ideal speaker-hearer," while rejecting any "grammatically irrelevant conditions" such as "memory limitations, distractions, shifts of attention and interest, and errors" (Chomsky, 1965, p. 3). In addition, I struggled with the cross-sectional, quantitative, and antisocial nature of many of the studies we covered, as they clashed with my own philosophy of the world that sees human beings as necessarily social creatures that use language to navigate through extremely complex and dynamic environments, both in our minds and in our interactions with the wider culture. So you can imagine the shock and joy I felt when I stumbled across the whole other side to this coin—the field of *Emergentism*, and the many subfields that fall under it. So, in this essay, I hope to expand on what I've learned about Emergentism and its related subtheories, provide some points of comparison between Emergentism and UG, explore the implications of Emergentism in the SLA field, and briefly address remaining issues for Emergentism research.

2. What is Emergentism?

Emergentism in applied linguistics can be described as a collection of theories that view language structures as complex patterns that arise from the interaction of more basic cognitive, social, and

environmental processes, and is often presented as the empirical adversary to nativist approaches like UG. Emergentists posit that as these processes continuously interact and co-regulate, complex and creative communicative behaviors naturally *emerge* as more than the sum of their parts, thus exhibiting novel properties that cannot be predicted based on observations of said parts (De Bot et al., 2007). Emergentism has its roots in many other fields, such as cognitive and developmental science, philosophy, psychology, biological evolution, physics, and statistics, and only within the last 40 years or so have researchers begun utilizing an emergentist approach in applied linguistics. Emergentists reject the idea that humans contain some innate proclivity for learning and producing language, and instead view language structures as a resulting phenomenon of non-linguistic factors and their interaction, such as "physiology, perception, processing, working memory, pragmatics, social interaction, properties of the input, [and] learning mechanisms" (O'Grady, 2008, p. 448).

Traditional emergentist approaches such as Elizabeth Bates and Brian MacWhinney's (1982) Competition Model and Nick Ellis' (2006) Usage-Based Approach focus heavily on the *frequency* and *reliability* of linguistic cues as guiding factors for language comprehension and production. Meanwhile, modern emergentist frameworks are concerned less with the linear developmental trajectories and group-level patterns presented in traditional emergentist research, and focus more on the insights that can be gained from studying unexpected individual differences that emerge from complex interactions in dynamic modeling (Larsen-Freeman, 2012). Modern subfields that are housed under the umbrella of Emergentism include Connectionism, which is a research approach that utilizes computer-modeled neural networks to simulate and gain insight on associative learning patterns in human language acquisition (Hummel, 2014), and Dynamic Systems Theory (DST), which studies how linguistic knowledge and behavior emerge over time through the interaction of multiple interconnected subsystems, with development characterized by variability, connected growth, and sensitivity to initial conditions (De Bot et al., 2007).

3. Emergentism & UG

To gain a clearer understanding of the main characteristics of Emergentism, it may be useful to compare it with claims made by Nativist approaches like Universal Grammar. This section is not intended to present Emergentism as the preferred or "correct" theory over UG—instead, I hope to provide a better understanding of Emergentism's main ideas (for uninitiated readers, and for myself) by presenting them in tandem with more widely known Nativist claims. First, at the foundation of both of these theories, a difference can be seen in how they define the concept of a *language*. At its inception, UG was a structuralist approach meant to focus on the recursive application of rules on a syntactic system, and Chomsky believed that the "primary goal" of a linguist should be to "describe the underlying rule system beneath the structure of all languages" (Chomsky, 1957, as cited in Hummel, 2014, p. 67). As previously discussed in the introduction of this paper, Chomsky has made clear his position that linguistic inquiry should stay confined to the study of the ideal speaker-hearer's "internalized language" or *I-language*, as it is this grammatical competence that will give us the clearest picture of the "underlying rule system" of human language (see Araki, 2017). On the other hand, emergentist frameworks view all aspects of human communication, including the "lexicon, phonology, dialog, meaning, and interpretation" of language, as crucial parts of the human language faculty, and conducts research under the view that these components work in tandem to create an "interlocking, unified system" (MacWhinney, 2019, p. 286). Thus, what Chomsky calls the "external language," or *E-language* of a speaker, is the main concern of emergentists, along with observing and explaining how this E-language emerges as speakers dynamically interact to express themselves and reach a conceptual consensus (Araki, 2017).

Perhaps more famously, this argument of *what language is* can be expanded to *where language comes from*—is there some sort of innate, biological *cause* of language within a human, or is language the *result* of a human's interaction with the external world? As a Nativist theory, UG considers language to be a uniquely human feature that we are all endowed with through our genetic makeup. UG also encompasses the idea of a "modular mind," in which innate language processing "organs" such as the

Language Acquisition Device (LAD) are autonomous structures in the brain, playing the primary role in facilitating language comprehension, production, and acquisition (Fodor, 1985). Fodor's modularity proposal has now been deemed a *moderate* modularity thesis, given that he originally emphasized the importance of "non-modular global psychological processes" working in tandem with specified modules (Samet & Zaitchik, 2017). More extreme modular mind models, such as Carruthers' (2006) *massive* modularity thesis, argue that non-modular central processing structures play little to no role in the acquisition and use of language. Emergentism, meanwhile, argues that linguistic knowledge is "built up *from experience* using *domain-general* cognitive abilities [emphasis added]," meaning there is no specific place in the brain that linguistic knowledge can be traced back to, or shown to originate from (Dąbrowska, 2019, p. 231). Because they do not believe there are innate mental structures that bring about language acquisition, Emergentists thus assert that language must emerge in an individual largely through their interactions with their environment, and is shaped by factors such as frequency, reliability, and perceptual salience (Ellis, 2007).

Thirdly, the way that UG and Emergentism treat the Critical Period Hypothesis (CPH) can be contrasted. The idea of a "critical period" in language acquisition was first introduced by Penfield and Roberts (1959), and it has evolved over the years into the Critical Period Hypothesis, or the theory that "there is a critical period favoring [rapid and automatic] language acquisition, after which native-speaker-like ability cannot be attained" (Hummel, 2014, p. 170). Some accounts of CPH expand on the nature of the critical period, associating the critical period with the embryonic stage in which predictable changes are determined almost entirely by genetic factors, while postnatal critical periods are better described as "sensitive periods." These sensitive periods (SP) are triggered at varying ages and for limited times, often due to an increasingly complex network of biological and environmental triggers (MacWhinney, 2006). Compared to the sharp declines postulated by critical periods, the boundaries for sensitive periods are "fuzzier," and "maintain the likelihood of a period which declines, but [does] not abruptly stop" (Riyahifar, 2016, p. 134). The exact age at which these sensitive or critical periods has

been placed varies dramatically depending on the study, its conditions, and the linguistic variable in focus, Some argue that general language acquisition ability begins sharply declining at age nine (Penfield & Roberts, 1959), around age 13 (Lenneberg, 1967), or perhaps most commonly (and vaguely), sometime after the onset of puberty. In regard to sensitive periods specific to certain linguistic abilities, the SP for pronunciation generally falls between 6 and 12 months (Tsao et al., 2005), while the SP for syntax has been speculated to run until around four years of age (Ruben, 1999). With CPH factored into the equation, it has long been contested whether the parameter-setting nature of UG is tied to these apparent sensitive or critical periods—and if so, whether UG disappears completely after L1 acquisition, or if this learning mechanism is simply inaccessible or overridden by some other mechanism past a certain age due to cognitive or social factors (DeKeyser, 2000).

In contrast, emergentist accounts do not believe that there is an “expiration date” on an adult's ability to learn language to a native-like level, per se. Most emergentists reject the idea that differences between L1 and L2 acquisitions can be explained entirely (or even primarily) by a single biological mechanism such as the passing of a sensitive or critical period. Instead, in typical emergentist fashion, this apparent decline in language learning ability is attributed to a complex combination of biological and cognitive factors, along with a variety of other external variables that are found only in adult learning environments (MacWhinney, 2006). This includes developmental and cognitive changes like firmly entrenched L1 patterns, parasitic L1 transfer, the development of metalinguistic knowledge and literacy, the ability to focus on form in language learning, and loss of brain plasticity (MacWhinney, 2019), along with social factors like the lack of a “silent period,” social exclusion, lack of time due to personal responsibilities, lack of input and opportunities for output, explicit instruction, and early exposure to abstract “adult” language (Lightbown & Spada, 2013, p. 38). However, as acknowledged by MacWhinney (2006), “little is to be gained” by attempting to separate age-related theories into nativist and emergentist categories, “since each of the views makes reference both to biological and psychological processes” (p. 139).

Thus, to conclude this section, a philosophical olive branch can be extended by discussing proposed points of similarity between innatist accounts and emergentist approaches. Although traditional rhetoric has often placed UG and Emergentism as armies on either end of a battlefield, recent efforts aim to identify common ground between the two camps. One area of similarity can be found in Dynamic Systems Theory (DST), a subfield of Emergentism with attempts to expand beyond the overly linear and computer-like Information Processing emergentist approaches (see Atkinson & Shiffren, 1968) by placing an emphasis on applying more domain-general algorithmic models onto real-world phenomena to gain a more holistic, *dynamic* view of L1 and L2 acquisition. DST is built upon the idea that, whether the field of focus is psychology, cognitive development, or linguistics, "every system is always part of another system, going from submolecular particles to the universe, with the same dynamic principles operating at all levels" (De Bot et al., 2007, p. 8). Within DST resides the concept of *attractor states* and *repeller states*, which are "preferred [or unpreferred] but not necessarily predictable" states that dynamic sub-systems have been observed to settle into as time goes on, before they are pulled in another direction by a stronger attractant or repellent force (De Bot et al., 2007, p. 8). Cooper (1999) applies these DST concepts to previous nativist accounts to show that the universal principles proposed by UG may be synonymous with "basins of attraction" in DST, which are strongly attracting linguistic states that arise from unpredictable processes rather than constraining parameters. Thus, DST models do not require an innatist approach to explain language acquisition because complexity (i.e., creativity) is able to emerge from a system of co-regulating subsystems unrelated to language, instead of some specialized Language Acquisition Device. However, contemporary evidence not only entertains, but supports the idea that certain universal biases presented by Nativist theories can be explored more robustly using DST methods.

4. Emergentism and its implications for SLA research

As mentioned above, although Emergentism originates from disciplines outside of applied linguistics, rapid advancements in corpora and computer processing technology has spurred on a new

wave of emergentist research in the field of Second Language Acquisition (SLA). One area of investigation that DST has been applied in is the "sensitive dependence on initial conditions" effect—or more colloquially, the *butterfly effect*—in which a small change in one's initial conditions when learning an L1 or L2 can have massive unforeseen effects later on. For example, De Bot et al. (2007) illustrates how DST modeling was used to provide insight on how a middle ear infection in early life can lead to slight phonological perception issues in a learner's L1 (Sparks et al., 1995), which may contribute to significant word-recognition issues in their L2 (Durgunoğlu et al., 1993). When even a small change in the initial conditions of an L2 learner's journey can have massive effects down the line, DST and other emergentist models may provide crucial insight on how complex, dynamic factors interact to induce these results in ways that cross-sectional studies focusing simply on a single variable like Age of Arrival or individual differences still cannot.

On a wider scale, because Emergentism views language as a combination of many complex, adaptive subsystems that are largely socially constructed, the effect of wide-scale adult L2 learning of, say, English as a Lingua Franca, may be more deeply understood through emergentist approaches. As Ellis (2008) elaborates, because adult L2 learners are not able to learn language as effectively as children, when a language is learned and perpetrated primarily by adults L2 speakers, the language tends to becomes "streamlined" and simplified—in other words, at the same time a learner adapts to the language, the language adapts to its speakers. This effect is already visible in Englishes around the world, such as the dropping of the third person present tense -s, as in 'She look very sad' (Seidlhofer, 2004, p. 236). With both a strong appreciation for the complex co-regulating effects that an individual idiolect and a cultural dialect can have each other, along with the tools powerful enough to dynamically model and understand these interactions, it can be argued that emergentist approaches are well equipped to expand our current understandings of World Englishes, in both a theoretical sense and a practical pedagogical sense.

5. Remaining issues for Emergentism

To close this essay, it may be appropriate to address the remaining issues for connectionist and emergentist research, as I am well aware that despite my instinctive preference for this framework, it is far from perfect, just like any other approach. Perhaps the most obvious problem with computer modeling-based emergentist research approaches is that *human beings are not computers*. In 1998, Nick Ellis argued that to believe a computer model could acquire full "communicative use of syntactic structures," it would need to have eyes and ears, and something that would resemble attention and focused listening—something we still have not been able to accomplish in full effect (p. 654). For example, MacWhinney (2006) describes an experiment in which a neural network was trained to assign grammatical roles to 178 different English sentence patterns. Once comfortable with these forms, the model was switched suddenly to Dutch, as if beginning to learn an L2—however, this sudden shift resulted in "catastrophic interference" that not only greatly limited the model's ability to process new Dutch grammatical forms, but also resulted in a decline in English processing ability. This "catastrophic interference" could only be avoided by carefully interleaving English and Dutch during training, which fails to account for the "many cases of real second language learning [that] involve major shifts in language environment" (p. 154), or by turning away from syntax entirely and shifting towards the lexical aspect as the focus of connectionist modeling.

Over twenty years later, Ellis' and MacWhinney's experiences remain relevant, even in an age when incredible strides have been made in the natural language processing abilities of LLMs like ChatGPT. That is because, to this day, computer modeling and deep neural networks cannot replicate the parts of human existence that Emergentism would argue makes language so enormously complex, yet so fascinating—computers cannot give us insight on how language affects and is affected by theory-of-mind phenomena, the development of self-identity, and human agency (Elman, 2005, p. 114). This issue is largely found in traditionally "siliconcentric" emergentist approaches such as Information-Processing theory and Connectionism (Westbury, 2002). But recently, more holistic approaches such as DST have

begun traversing this theoretical chasm, by attempting to provide quantitative empirical support for qualitative observations, thus "bridging the gap between holistic and reductionist views in SLA" while reducing the amount of human labor previously needed to analyze and understand the massive amounts of data contained in a complex, dynamic system like language (de Bot et al., 2007, p. 19).

6. Conclusion

Emergentist approaches in applied linguistics and SLA research have more than proven themselves as a lively and fruitful area of study since their earliest applications over forty years ago. First arising as an alternative approach to understanding the essence of language acquisition in response to the overwhelming influence of Nativist frameworks such as UG, Emergentism attempts to reunite mind with matter through a dynamic perspective that views language as emerging from the interaction of general cognitive processes, environmental input, and social contexts. Emergentism and UG clash in many ways, including how each theory views the definition and origin of human language, the significance of non-syntactic factors on linguistic research, and why language can be reliably mastered by the young but unflinchingly butchered by the old. However, recent attempts to recontextualize contemporary research have hinted that Emergentism and UG may be more similar than we expected in how they view universal patterns in grammar. As contemporary SLA research has shown, Emergentism offers a multitude of powerful tools to model complex, dynamic interactions in language acquisition, such as the butterfly effect and the adaptive interplay between individual and cultural language systems. Although emergentist approaches such as connectionism and DST face limitations due to their reliance on computer modeling, which struggles to account for uniquely human factors, this only reiterates the need for integration with qualitative studies to fully capture the intricacies of language acquisition and use. This essay represents my first attempts at comprehending Emergentism as a viable linguistic theory, and thus is bound to sound infantile and naïve to a more experienced linguist, no matter their theoretical creed. But it was largely an intuitive sense of quality that initially drew me towards Emergentism, and through my research, this call

of value has only grown brighter at the heart of this approach. Who knows what kinds of cognitive, emotional, intellectual, and philosophical factors interacted at once to draw out such a dramatic sense of intrigue when I saw the words “Complex Dynamic Systems” flash on screen during class that day—but whatever it was, it got me hooked. The only thing I know for sure is that this essay will not be the last of its kind.

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