EMERGING FROM SILOS OF ANALYSIS: A COMPLEXITY THEORY APPROACH TO THE STUDY OF BIBLICAL TEXTS

Sophia L. Pitcher

**1.0. Introduction**

Language is a complex system (Larsen-Freeman 1997; Larsen-Freeman and Cameron 2008; Ellis and Larsen-Freeman 2009a). Together, the many dimensions of language comprise an intricate nexus of heterogenous components that often interact in surprising ways. Some of the dimensions of language, including grammar, orthography and the written transmission of texts, language acquisition, and language variation, comprise complex systems in themselves, and higher-level dimensions of language can be reduced to reveal complex components at lower levels of organisation. For example, some of the components of the grammar of a language include syntax, morphology, phonology, and discourse-pragmatics. These components interface at various levels and to varying degrees, forming dynamic and often nonlinear phenomena. For example, the phonological dimension not only includes a language’s sound system as represented by its consonants, vowels, and lexical tones (if present), but it also includes prosodic phonology, with its own array of constituent features that interact with syntactic, morphological, and discourse-pragmatic domains.

Conceptualised as a complex system, language consists of multi-dimensional layers that are distinct but nonetheless interrelated—each layer influencing the other, while simultaneously shaping the system as a continuously evolving whole. This hierarchical interconnectedness characterises the nature of complex systems. As Baicchi (2015) describes, complex systems are

heterogenous entities that, interacting with each other and with their environment, generate multiple layers of collective structure exhibiting hierarchical self-organisation without centralised control (2015, 10).

Characterising language in such a way encourages analyses that are also multi-dimensional and that seek to account for linguistic phenomena as they exist within the system. Although a complex systems approach may threaten an analysis with a bewildering degree of variability, it offers two clear and compelling benefits: 1) an awareness of the empirical nature of the object of study, which includes the presence of other phenomena that share its nexus, and 2) a theoretical grounding that aims to provide greater analytical integration of seemingly disparate factors operating within the system. In other words, a complex-systems approach to language recognises that isolated analyses simplify and often obscure the object of study (see Larsen-Freeman 1997; Larsen-Freeman and Cameron 2008, 9; Schwarzhaupt 2013, 262), and perhaps more fundamentally, it “offers greater coherence in explaining what [is] already know[n]” (Larsen-Freeman and Cameron 2008, 11). It is for these reasons that a complexity approach to language, despite its being a relatively new linguistic theory, is quickly gaining traction in the field of linguistics and transforming the way language phenomena are understood. This systems-view is also beginning to shift the way biblical scholars analyse and translate biblical texts.

**2.0 Complexity Theory: Core Commitments and Historical Development**

Complexity Theory is chiefly concerned with the description and modelling of the relationships between the components of complex systems—particularly, the relationships that emerge from changing and often unexpected interactions among the system’s components. According to Larsen-Freeman and Cameron (2008), seven core attributes characterise complex systems: 1) dynamism, 2) heterogeneity, 3) openness, 4) interconnectedness, 5) emergence, 6) nonlinearity, and 7) adaptation. Let’s briefly describe these core attributes.

First, complex systems are dynamic. The dynamism of a complex system refers to its non-static nature; it is a system in constant flux (Larsen-Freeman and Cameron 2008, 29–30). In fact, Larsen-Freeman and Cameron assert that dynamism is likely the defining feature of language as a complex system (2008, 25) because “language, language use, and language development are continuously in action” (2008, 29).

Second, unlike simple systems (e.g., a traffic light [see Larsen-Freeman and Cameron 2008, 27]) that are comprised of “a small set of similar components…connected in predictable and unchanging ways” (2008, 27), complex systems embody a multiplicity of heterogenous components.

Third, complex systems are open. Unlike closed systems, those that are open allow energy, matter, or other influences to enter from the outside (Larsen-Freeman and Cameron 2008, 32). This means that open systems “not only adapt to their contexts but also initiate change in those contexts; these systems are not just dependent on context but also influence context” (Larsen-Freeman and Cameron 2008, 34).

This leads to the fourth attribute of complex systems—interconnectedness. Complex systems exhibit interconnectedness between their numerous components, dimensions, and contextual factors, such that a change in one of these domains can lead to change in the others.

The fifth attribute of complex systems is emergence. Complex systems exhibit emergent behaviour when dynamic interactions between lower-level components and dimensions of the system give rise to new phenomena that contribute to the nature of the system (Larsen-Freeman and Cameron 2008, 58–60; Marais 2019, 47–49). Accordingly, the whole of the system is not simply the sum of its parts, but what emerges when the parts of the system interact.

The sixth characteristic attribute of complex systems is nonlinearity. Larsen-Freeman and Cameron (2008, 31) define this feature as “change that is not proportional to input.” In other words, small quantitative differences within a single dimension of a complex system can generate significant qualitative differences throughout the system(Beckner et al. 2009, 16).

Finally, complex systems are adaptive. Larsen-Freeman and Cameron (2008) define adaptation as “the process in which a system adjusts itself in response to changes in its environment” (2008, 33).

Although the philosophical antecedents of complexity theory can be traced back as far as the Ancient Greek philosopher Heraclitus (circa 500 BCE) (Baicchi 2015, 10), who described the material world as interconnected and in continuous flux, Larsen-Freeman and Cameron (2008, 2-3) credit mid twentieth century scientists like Conrad Waddington and Ludwig von Bertalanffy with formulating the most influential precursors of Complexity Theory. They cite Waddington’s description of embryogenesis in 1940 as a pivotal systems description. Within this conceptual framework, an embryo is not fully determined by genetic information, but rather (Larsen-Freeman and Cameron 2008, 2):

each step in the process of development creates the conditions for the next one. In other words, ‘the form of the body is literally constructed by the construction process itself—and is not specified in some pre-existing full instruction set, design or building plan….’ (van Geert 2003, 648-649).

In a similar vein, in 1950, biologist Bertalanffy proposed a general systems theory that described “an entity as the sum of the properties of its parts” (Larsen-Freeman and Cameron 2008, 2). In doing so, he eschewed reducing an entity to any one of its parts, underscoring the importance of the “relationships among the parts which connect them to the whole” (Larsen-Freeman and Cameron 2008, 3).

Over the next three decades, scientists continued to develop a systems approach to natural phenomena (see Larsen-Freeman and Cameron 2008, 3–4). In the 1980’s, this field of research culminated in the founding of the Santa Fe Institute. The institute quickly became the hub for exploring the nature of complex adaptive systems, where Complexity Theory was formalised and multidisciplinary research flourished (Larsen-Freeman and Cameron 2008, 3). The application of Complexity Theory has been extended to such diverse fields (see Larsen-Freeman and Cameron 2008, 3–7; see also Pearce and Merletti 2006) as business management (Battram 1998), physics (Gell-Mann 1994), epidemiology (Pearce and Merletti 2006), psychology (Spivey 2007), economics (Arthur 2013), and translation and development studies (Marais, 2014).

At the close of the century, Larsen-Freeman pioneered a complexity approach to applied linguistics, exploring the merits of a complexity model for language acquisition and second language instruction. Her primary hope for developing complexity thinking within her field was that “the dynamics of complex nonlinear systems [would] discourage reductionist explanations” (Larsen-Freeman 1997, 142). For Larsen-Freeman, much of the theoretical appeal of Complexity Theory lies in the dynamic and holistic metaphor that it engenders, enabling researchers to perceive fundamental properties and interactions of language phenomena that remain opaque to traditional theoretical frameworks. She argues that the insights that emerge from a complexity approach are not equally accessible to these frameworks because at their core they reduce or isolate the object of study, and in doing so obscure it.

Perhaps most fundamentally, Larsen-Freeman (2013, 370) understands Complexity Theory to be a metatheory “still necessitating object theories,” (viz. discipline theories). According to Larsen-Freeman, it is precisely this characteristic that endows Complexity Theory with one of its greatest advantages—transdisciplinarity: CT “avoided the splintering of disciplinary knowledge and creates instead new forms of knowledge, which are thematic, cutting across disciplinary boundaries” (2013, 370). In fact, Marais (2014) considers the trajectory of Western scholarship toward interdisciplinarity and complexity frameworks to be inevitable:

In a sense, complexity thinking seems to be inevitable. The whole program of Western science has focused on analyzing the parts of reality in order to understand them better…. Now, the realization is dawning on scholars that analysis can only take you so far, because only a small part of reality is to be explained by the way parts are, or only a small part of reality can be understood by understanding the parts of it. Much of reality is to be explained not by the parts themselves but by the way in which they relate to one another or by the way in which they are becoming, the way in which constituent parts form wholes… The focus has thus shifted from an analysis of parts to a focus on the relationships and connections between parts and between parts and wholes. Also, the focus has shifted form an interest in phenomena to an interest in processes, that is, the way in which phenomena are the result of the interaction of their constituent parts (2014, 18).

Marais (2014) is also quick to point out that while the notions of movement, process and interdisciplinary synthesis factor into the descriptions of complex systems, they are not of primary importance. For Marais, states, being, and disciplinary analysis are equally important notions since they too characterise reality:

The philosophical problems of stasis and movement, and of how both constitute reality, are within the purview of complexity thinking. Let me hurry to say that I do not suggest replacing analysis with synthesis or being with process. I hope to incorporate these binaries in a complexity view in which both sides of the binary find their rightful place in thinking about a particular phenomenon (2014, 18).

Having outlined the core commitments of complexity theory and its development within the field of linguistics, I will briefly share how I use a complexity approach to the cantillation accents of the Masoretic Text to identify their precise nature and account for their traditionally recognised functions.

**3.0. Complexity Approach to the Cantillation Accents of the Masoretic Text**

The current accepted model for the cantillation accents of the Masoretic Text is rooted in a 19th century philological algorithm known as Wickes’ (1887) Law of Continuous Dichotomy (LCD), which reduces the accents to a system of pausal segmentation. However, in my analysis of the system, I depart from the LCD completely in order to advance a linguistic model for the Masoretic cantillation accents. I argue that LCD models should be replaced by a cross-linguistic complexity analysis for five main reasons: 1) scholars have long acknowledged the prosodic nature of the system (Spanier 1927; Lazarus 1942; Janis 1987; Dresher 1994; Strauss 2009; DeCaen and Dresher 2020; Park 2020), but the LCD does not treat the accentual system as natural language phenomena; 2) the LCD is a philological algorithm with no theoretical basis outside of itself, which treats the accentual system as an isolate without correspondence to analogous linguistic phenomena; 3) the LCD artificially reduces the accentual system to a single phonological feature—namely pause; 4) a cross-linguistic complexity model allows us to identify the precise nature of the accentual system and to integrate its seemingly disparate features, including melody, stress, phrasal structure, syntactic structure, and meaning; and 5) a cross-linguistic complexity model provides the necessary theoretical framework to evaluate and test the system’s functions.

According to Yeivin (1980, 158) the accents are traditionally understood to perform three functions: 1) to represent the melodies that accompany the reading of the text, 2) to mark the locus of lexical stress, and 3) to mark semantic units (1980, 158) —that is, to contribute to the meaning of the text in some way. A cross-linguistic complexity model unifies these functions within the theoretical framework of prosodic phonology. Within this model, the accentual graphemes constitute a prosodic orthography, where conjunctive and disjunctive graphemes are iconic representations of pitch accents at three levels of contrastive pitch—namely, low, high, and very high pitch (2020, 145–158, 189–192; see also Wickes 1887, 13–14; Lazarus 1942, 283–286)—embedded within two main domains of prosodic phrase structure. In other words, the orthography of the accents represents pitch fluctuations in the flow of speech that are associated with the locus of lexical stress, with disjunctive accents additionally indicating the locus of two types of cross-linguistically distinct phrasal boundaries—namely, those of the intermediate phrase (φ) and the intonational phrase (ι).

This cross-linguistic complexity model, however, not only identifies the precise nature of the accentual system, but it also provides a way to assess its functional semantic features. For example, relative clauses, which have attested cross-linguistic prosodic features (Nespor and Vogel 2007, 188), provide an accessible syntactic domain to test how the prosodic system represented by the accents contribute to the meaning of the biblical text. Semantically nonrestrictive relative clauses, which provide supplemental information for an already identifiable referent, form intonational phrases separate from their head nouns. Semantically restrictive relative clauses, which modify the head noun by restricting the identification of the referent, form cohesive intonational phrases with their head nouns.[[1]](#footnote-1)

The prosodic features that distinguish the semantic restriction of relative clauses cross-linguistically are also present in the prosodic record of the Masoretic Text. Example (1) illustrates a Tiberian Hebrew relative clause that is semantically restrictive, where the head noun (בְּנ֛וֹ) shares a cohesive intonational phrase with its relative clause (אֲשֶׁר־יָלְדָ֥ה הָגָ֖ר):

(1) ι(φ(בֵּ֑ן) φ(לְאַבְרָ֖ם) φ(וַתֵּ֧לֶד הָגָ֛ר))

((*wattēled hāgār*)φ (*lǝʾabrām*)φ (*bēn*)φ)ι

((and.she.bore Hagar)φ (to.Abram)φ (son)φ)ι

ι(φ(יִשְׁמָעֵֽאל׃) φ(אֲשֶׁר־יָלְדָ֥ה הָגָ֖ר) φ(וַיִּקְרָ֨א אַבְרָ֧ם שֶׁם־בְּנ֛וֹ))

((*wayyiqrāʾ ʾabrām* ***šem-bǝnô***)φ (***ʾăšer-yālǝdâ hāgār***)φ (*yišmāʿēʾl*)φ)ι

((and.he.called Abram **name.of-his.son**)φ (**whom-she.bore Hagar**)φ (Ishmael)φ)ι

And Hagar bore to Abram a son. And Abram called the name of his son whom Hagar bore, Ishmael. (Genesis 16:15)

Example (2) illustrates a Tiberian Hebrew relative clause that is semantically nonrestrictive, where the proper head noun (יְהוָ֑ה) and relative clause (אֲשֶׁ֧ר הוֹצִֽיאֲךָ֛) constitute separate intonational phrases.

(2) ι(φ(הִשָּׁ֣מֶר לְךָ֔))

((*hiššāmer lǝkā*)φ)ι

((be.guarded for.yourself)φ)ι

ι(φ(אֶת־יְהוָ֑ה) φ(פֶּן־תִּשְׁכַּ֖ח))

((*pen-tiškaḥ*)φ (***ʾet-YHWH***)φ)ι

((lest-you.forget)φ (**D.O.-LORD**)φ)ι

ι(φ(מִבֵּ֥ית עֲבָדִֽים׃) φ(מֵאֶ֥רֶץ מִצְרַ֖יִם) φ(אֲשֶׁ֧ר הוֹצִֽיאֲךָ֛))

((***ʾăšer hôṣîʾăkā***)φ (*mēʾereṣ miṣrayim*)φ (*mibbêt ʿăbādîm*)φ)ι

((**who he.brought.you**)φ (from.land.of Egypt)φ (from.house.of slaves)φ)ι

Guard yourselves, lest you forget the LORD, who brought you out of the land of Egypt, from the house of slavery. (Deuteronomy 6:12)

Another example of the semantic feature of the Masoretic accentual system involves the disambiguation of tripartite verbless clauses from left-dislocated verbless constructions. Using a cross-linguistic framework, Naudé and Miller-Naudé (2017, 233) note that syntactic left-dislocation “involves a gap at the boundary between the dislocated constituent and the matrix sentence”, which can be realised by a pause, interjection, (Berman-Aronson and Grosu 1976) or intonational contour (Korchin 2015, 14–15). Naudé and Miller-Naudé use this gap feature to disambiguate the subject NP of a tripartite verbless clause from a left-dislocated NP construction. They observe that a left-dislocated NP in the biblical text is phonologically characterised by a disjunctive accent that separates it from the matrix clause, while the pronoun of a tripartite clause is phonologically conjoined to subject NP. The prosodic formats of these two types of constructions confirm this analysis.

Example (3) exhibits the prosodic format of a left-dislocated verbless construction, where a prosodic phrase boundary separates the 3ms subject pronoun (ה֖וּא) from the topicalised NP (וְחָ֕ם).

(3) ι(φ(אֲבִ֥י כְנָֽעַן׃) φ(ה֖וּא)) ι(φ(וְחָ֕ם))

((***wǝḥām***)φ)ι ((***hûʾ***)φ (*ʾăbî* k*ǝnāʿan*)φ)ι

((**and.Ham**)φ)ι ((**he**)φ (father.of Canaan)φ)ι

And Ham, he was the father of Canaan. (Genesis 9:18)

Example (4) exhibits the prosodic format of a tripartite construction, where the 3ms pronoun (ה֖וּא) shares the same internal intermediate phrase with the subject NP (הָאָשָׁ֥ם).[[2]](#footnote-2)

(4) ι(φ(לַכֹּהֵ֔ן) φ(הָאָשָׁ֥ם הוּא֙) φ(כַּ֠חַטָּאת) φ(כִּ֡י))

((*kî*)φ (*kaḥaṭṭāʾt*)φ (***hāʾāšām hûʾ***)φ (*lakkōhēn*)φ)ι

((for)φ (as.the.sin-offering)φ (the.guilt-offering PRON)φ (priest)φ)ι

For just like the sin-offering, the guilt-offering belongs to the priest. (Leviticus 14:13)

These examples demonstrate that a cross-linguistic complexity approach to the cantillation accents can more precisely identify and unify what is already known about the system, while also providing scientific avenues for exploring its semantic and discourse-pragmatic functions.

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1. The prosodic data of relative clauses within the 21 Books of the Hebrew Bible include prosodic formats that are prosodically ambiguous with regard to restriction (Pitcher 2020, 333-355). Note that this type of prosodic ambiguity has been attested in Birkner’s (2012) study on the prosodic realisations of relative clauses in German. Birkner’s study demonstrates that these prosodic realisations are “more heterogeneous than...presented in grammar books, complying neither with dichotomous semantics nor with the two postulated formats” (2012:20). [↑](#footnote-ref-1)
2. Naudé and Miller-Naudé (2017:223) describe the pronoun in a tripartite verbless clause as a “last resort syntactic strategy” (viz. PRON) for disambiguating the subject NP. [↑](#footnote-ref-2)