If phonology is flat, it must be linear, or is it neither?

Harry van der Hulst

1 Introduction

In this article, I evaluate the claim that phonology is 'flat'. As shown in Scheer (2004, 2013, 2023), the development of *Government Phonology* replaced the syllable by a linear, so-called *lateral* relation between onsets and rhymes. Then, with the development of Jean Lowenstamm's 'strict CV' variant (Lowenstamm 1996), onsets and rhymes as potentially branching constituents were removed as well. The coherence of the phonological representation within words is now captured in terms of several lateral government and licensing relations[1] which are not meant to establish, or apply within, a constituent structure. Without syllables, there can be no feet either (see Takahashi 1993). All word-internal constituent structure, once proposed, is thus gone. As for higher, so-called *prosodic structure*, a common view is that this kind of structure, however it is represented, is derived from, or identical to, the morphosyntactic structure (see van der Hulst 2010a), but some would argue that higher prosodic structure is not constituent-based either and thus flat, with boundary symbols indicating grouping where required. Scheer (2008) has called the prosodic hierarchy *diacritic* and proposed to encode its intended function of partitioning the phonological string with empty CV units. Indeed, the need for tree structures in phonology as a whole (whether within or above words) has been called into question in van der Koot and Neeleman (2006) and Reiss (2008), among others. Essentially, the linear view resurrects the theory of Chomsky and Halle (1986). According to Scheer, the claim that phonology is flat, i.e., not constituent-based, implies that there is no recursion in phonology, unlike in syntax. When constituency and recursion in higher prosodic structure (i.e., above the level of simplex words) *is* deemed necessary, a common view despite the denials mentioned here, it is claimed that it is not autonomous but rather reflects morphological or syntactic recursive structure (although it need not be completely isomorphic to it). Unlike phonological representations, syntactic representations *are* usually regarded in terms of constituent structures which, however, are taken to *not* account for the linearity of their terminal elements ('structures, not strings'; Everaert et al. 2015). In contrast, Scheer and others claim that phonology is string- and not structure-based (apart from licensing and government relations which of course encode some kind of structure; I return to asking what kind of structure this is in section 8.

The claim that there is no such thing as syllable structure that involves some kind of constituent structure, however internally represented, is not generally accepted; it has been questioned outside the purview of Government Phonology as well.[2] Elsewhere I

[1] Government and licensing account for absence and presence of content, respectively.

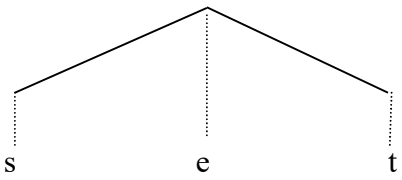
[2] Interestingly, after the syllable, which was not part of the representational theory in Chomsky and Halle (1968), had been welcomed in generative phonology as a necessary unit, various phonologists later questioned the need for it, specifically arguing that an account of phonotactic restrictions can appeal to phonetic factors (Steriade 1999; Blevins 2003). Space limitations prevent me from discussing these ideas in this article. For a discussion of the factors that determine phonotactic restrictions, see Krämer and Zec (this volume) and Garvin (this volume).

have pushed back on the idea that phonological representations are flat, taking the position that syllable structure is needed (specifically with an internal onset/rhyme substructure) and I have even entertained the possibility that syllable structure is recursive; see van der Hulst (2010a) and Den Dikken and van der Hulst (2020). In section 2, I briefly outline some aspects of Dependency Phonology which is my frame of reference (see van der Hulst 2020). In section 3 I evaluate Scheer's argument for why phonology is flat. In section 4 I briefly repeat the argument for why recursion within syllables is to be expected, while section 5 explains why its usage in this domain is limited. Section 6 explains that postulating recursivity in syllable structure allows us to dispense with 'metrical feet' (which I have long argued for on independent grounds are not needed to account for stress patterns; see for example van der Hulst 2012, to appear a). It is also mentioned that an additional gain is that we can provide a principled, constituent-based account of certain common patterns of poetic rhyme. In section 7 I suggest that Scheer's model of Government Phonology is a dependency model of sorts and I show that recursivity in such a model is entirely possible. If phonology is in fact not flat, we should ask, as John Anderson has done, whether linearity can be extracted from phonological representations, at least to some extent. Section 9 offers my conclusions.

2 Dependency Phonology

Competing with the structuralist and generative constituent-based theories of syntax, non-constituent-based theories of syntactic structure have been proposed, notably in the context of Dependency Grammar (Tesnière 1959; Hayes 1964; Imrényi and Mazziotta 2020), and, for example, Word Grammar (Hudson 1984), or Arc Pair Grammar (Johnson and Postal 1980) in which relations between the words that make up sentences are encoded very differently. In Dependency-based approaches sentences are linear strings of words, relations between which are captured in terms of 'lateral' dependency relations. What makes matters complicated is that dependency relations can be graphically represented with graphs that look a lot like constituent structures, in which dependent units are 'adjoined' to other units that are their heads. Anderson and Ewen (1987) present a model of Dependency Phonology (DP) which employs graphs like the following:[3]

(1)

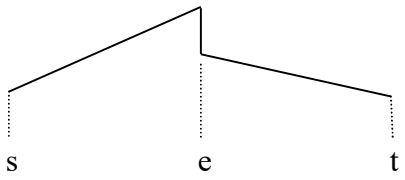


In this graph the onset and coda consonants are equal dependents of the head vowel. The resemblance between a constituent-based approach to syllable structure and a dependency approach is especially close given that Anderson's version of this approach does not only

[3] John Anderson's work on dependency phonology goes back to the early 1970s, with recent comprehensive works: 2011abc, 2022ab in which he unfolds a dependency approach to the whole of grammar. For a survey of Dependency Phonology, see van der Hulst and van de Weijer (2018).

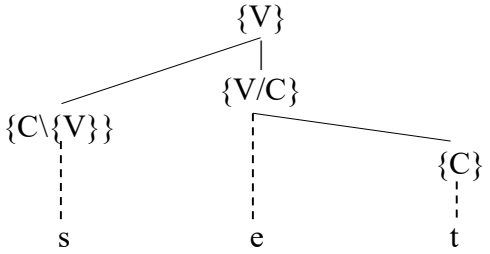
involve *adjunction*, but also *subjunction*. In the latter case an element, /e/ in this case, is head of two successively more inclusive constructions:

(2)



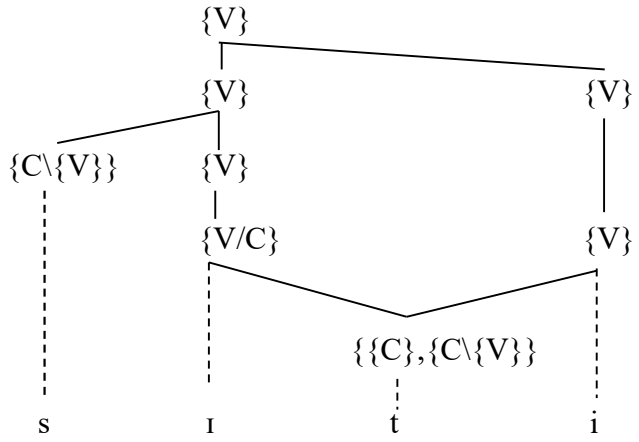
Here /e/ is dominated by two nodes in the dependency graph, one subjoined to the other. The /t/ is taken to be a directly dependent on the vowel, while /s/ is dependent on the vowel via the unit /et/ (see section 4 for what motivates this difference). Anderson (2011c: 83ff) offers a more elaborate notation to represent the various nodes. In (3), the '/' indicates 'looking for a complement', while the '\' notation stands for being an adjunct. The labels 'C' and 'V' represent unary phonological elements, i.e., primes of segmental structure. The symbols 's', 'e', 't' are a shorthand for the other segmental unary primes that DP uses.

(3)



A difference between *rooted* constituent graphs and dependency graphs is that the latter permit one daughter to be dependent on two heads, which creates a structure that captures the notion of *ambisyllabicity*:

(4)



Here I have also included the dependency relation that represents 'foot structure'. Indeed, early work in DP anticipated the essence of metrical theory by representing word stress as an exponent of a dependency relation between two syllables.

We must of course not capitalize on the *visual* appearance of graphs for constituent structures and those for dependency relations, but chances are that theories that advocate constituent structures that are augmented with head/dependency encoding (as is standard in generative syntax since Chomsky 1970 and since then in various phonological theories of syllable structure and word stress) and theories that appeal to non-constituent-based dependency allowing both adjunction and subjunction might come very close and may be notational variants to a large extent (see Osborne et al. 2011). In any event, as shown here, the fact that dependency relations can be represented with graphs that come very close to the graphs used for constituent structure, calls into question that a dependency, non-constituent-based approach is committed to the idea that phonological representation that exclusively rely on dependency relations are 'flat'. I mention this point here because I will suggest in section 7 that Lowenstamm's and Scheer's Government Phonology, that postulates lateral relations, which *are* head-dependency relations, could be interpreted as a form of dependency phonology. If this is so, Scheer's claim that phonology is flat collapses. This is also important because, if Scheer's version of Government Phonology is a dependency theory, it would in fact permit recursive structure, as I show in section 7.

3 Why constituency in phonology would not be needed

To motivate that syntactic structure is quite unlike phonological structure, Scheer (2023) points out that phonological structure does not involve *concatenation*, while the structure of complex words and sentences (hence syntax) does.

> No dominance or hierarchy can exist without items having been merged. Note that here and below the term *concatenation* only refers to the operation whereby items taken from long term memory are glued together. Syntax does that, but phonology does not. (p. 281, fn. 7)

He then also affirms that by implication there can be no recursion in phonology:

> Arboreal structure being thus unavailable to phonology, hierarchy is expressed by a different means, which concords with its linear conditions: lateral relations. If there are no trees in phonology, of course the existence of recursion is excluded. No concatenation, no trees – no trees, no recursion. (p. 269)

The claim is that in phonology we do not *combine* (or *merge*) things, because the phonological structure of words (or morphemes) is stored in the lexicon in terms of linear strings.[4] Note that in this quote Scheer seems to imply that both syntax and phonology are "hierarchical", albeit that hierarchy is expressed by different means. This is also made clear in the following quote:

[4] When complex words are formed, there is concatenation, but the result constituent structure would be syntactic (within the word) and not phonological.

> Concatenation and linearity are thus in complementary distribution: concatenation is present in syntax but absent from phonology, while linearity is an input condition of phonology that is unknown in syntax. This correlates with the existence of different means to express hierarchy: phonology has no trees because it does not concatenate anything; there cannot be any lateral relations in syntax in absence of linearity. That is, trees in syntax and lateral relations in phonology are two ways of expressing hierarchy that are adapted to the design properties of their environment. (p. 284)

In the first quote, Scheer says that phonology can*not* be hierarchical ("No dominance or hierarchy can exist without items having been merged"). However, the other quotes suggest that he regards constituent-free phonological structure as hierarchical due to the lateral relations that it contains. I must conclude that the first quote reveals a slip of the pen and that Scheer's notion of phonological *hierarchy* refers to the fact that the lateral relations that provide coherence in the linear phonological string in his theory of phonology provide some kind of hierarchical structure, which is, however, not clearly defined. In any event, his use of the notion 'hierarchical structure' does not imply constituency which is what most linguists would require to use this term.

Terminology aside, it is not obvious that an object can only have a constituent-type structure if it arises from combining (merging) two objects that are stored in memory (in the lexicon or in a workspace):

> There is no grammar in absence of the concatenation of pieces that are independently stored in long-term memory, and there is no speech without linearity: linguistic structure needs to be linearized in order for speakers to be able to encode it physically, i.e. in the vocal or signed modality. (p. 284)

It is of course true that the phonological material that makes up simplex words (or morphemes) is stored as such in the lexicon. This, however, does not entail that this material is necessarily a linear string of segments just because this is how it is manifested in external language, i.e. when we utter these words. This applies as much to the necessary linearity of segments within words as it does to the linearity of words within a sentence. If the necessary linearity of words does not imply that syntactic structures express linearity, this allows for a view that the linearity of segments is not encoded in phonological representations, but instead that such representations are purely hierarchical; see Anderson (1987) for a defence of this idea at the level of syllable structure.[5]

Let us focus on Scheer's claim that phonological presentations must be linear because they do not result from concatenation. However, there is no logical connection between how an object comes about and how it is structured. Scheer's idea seems to be that the merge operation is a 'dynamic' process, rather than being a 'static' account of wellformedness. (The same confusion often occurs with the use of the term *generate*.).

[5] See Golston and Kehrein (this volume) for an argument that the segmental core is formed by manner/place units (which they call *seglets*) with laryngeal and secondary features being specified at the level of syllabic constituents. In van der Hulst (2005b) is idea was incorporated in the model proposed there. However it was not adopted in van der Hulst (2020, section *3.2.4 The segment–syllable connection*).

Besides, Scheer does not deny that native speakers can in fact *make* new morphemes (for brand names or when cheating in playing scrabble), which, I would argue, involves dynamic concatenation. However, the crucial point is that native speakers have grammatical (phonological) acceptability judgments about whether a given string of segments is a possible word or not. To do that, they would have to mentally concatenate segments in the string to check whether it is wellformed, which means that they compute a constituent structure (or a dependency structure for that matter) if that is the optimal way to account for wellformedness.[6] In conclusion, the distinction that Scheer makes between creating syntactic structure by concatenation and phonological representations being stored does not have a bearing on whether or not both domains display constituent structure unless there is a logical argument to prove that constituent structure is necessarily a record of how a string is produced (i.e., a record of its *derivational history*). This then leaves open whether or not said strings actually have a constituent structure. The usual argument for constituent structure is to show that rules or constraints are structure-dependent. While this is undisputed in the domain of syntax, the fact that phonological rules or constraints often depend on syllabic structure has been an argument for restoring the notion of syllable structure after Chomsky and Halle (1968) had removed this notion from their phonological vocabulary.

The idea that phonology is flat has gained popularity in broader circles. Fitch (2018) argues that the claim that phonology is strictly linear, while syntax is not, may have an evolutionary grounding. He proposes the *Continuity hypothesis* according to which a phonological computation is close to bird song, citing van Heijningen et al. (2009); see also Berwick at al. (2011); Samuels 2009 and Yip (2013). Some of thse authors identify a grouping structure that they represent in terms of a 'stacked' or 'layered' hierarchical structure, i.e. a structure that does not display recursion. Fitch suggests that human language started as a predominantly string-like system, based on capabilities that our ancestors shared with many other species, including species that are still around, songbirds often coming to mind. Fitch's view on the evolution of human languages is that at some point the linear capacity was augmented with an 'arboreal' capacity, which then gave rise to syntax, making a direct account of linearity in sentence structure unnecessary.

The idea that phonology is somehow less complex than syntax (which here means that it is string-based, whereas syntax is not) is supported by claims that phonology requires less computational power (essentially, finite state grammars) than syntax which sits significantly higher in the 'Chomsky hierarchy'. The work by Jeffrey Heinz and collaborators has shown that syntactic patterns and phonological patterns point to the need for different kinds of formal grammars, as originally defined in the so-called Chomsky-Schützenberger (1963) hierarchy of formal languages or grammars. In this view, phonology falls with the subregular region of that hierarchy, while syntax reaches into the region of mildly-context-sensitive grammars; see Chandlee and Heinz (2022). Using arguments from formal languages theory, the claim that syntax is different from phonology, specifically in displaying recursion, is also defended in Idsardi (2018). Here we must consider the claim made by Thomas Graff (2022) that both syntax and phonology require the same formal grammars, occurring lower in the Chomsky hierarchy

[6] Of course, this has been disputed in the work mentioned in footnote 2. In section 4 I argue that flat views of the syllable fail to account for some basic facts.

where originally only phonology was placed. The crux of Graff's case is that syntax does not require more powerful grammars than phonology if it applies to structures rather than terminal nodes (as was the case in the original approach). We should note that, while his idea crucially presupposes that syntactic grammars operate on structures, it does not actually rely on phonological representations being flat. This brings us back to the claim that these phonological grammars *can* account for phonological phenomena if phonological representations are flat, whereas this would not be so in the domain of syntax.

What must we conclude from the finding that phonological phenomena, from the viewpoint of Formal Languages Theory, only need flat representations?[7] Has it actually been shown in Formal Languages approaches that *all* phonological phenomena that have been used to motivate syllable structure can be accounted without an appeal to such structure *without missing significant generalizations*? Here we must recall a classic argument for why reference to syllable edges circumvents the disjunction that was necessary in SPE where the notion 'syllable-final' was analysed in terms of the disjunction {#, C}, which is an arbitrary disjunction. Perhaps showing that a flat analysis is possible (for example by using boundary symbols) does not entail that the mean that the linear analysis is explanatory. Secondly, but relatedly, does the 'fact' that accounts of phonological phenomena do not *necessarily* require reference to constituency precludes the possibility that the human mind captures them nevertheless as being dependent on hierarchical structure, given that such dependence is independently motivated to account for syntactic phenomena?

It is of course well-known that there are syntactic phenomena that are apparently missing in phonology, notably long-distance relationships that crucially rely on arboreal structure. However, long-distance relationships do occur in phonology (Poser 1982). It is true that such non-local relations *can* be accounted for by invoking multiple phonological tiers, rather than some hierarchical constituent structure, but insightful accounts that appeal to binary branching trees have also been proposed.[8]

An often-mentioned difference between syntax and phonology regards recursion, which is claimed to be absent in phonology. It is quite common to find statements like the following:

> "Recursion consists of embedding a constituent in a constituent of the same type, for example a relative clause inside a relative clause (…). This does not exist in phonological structure: a syllable, for instance, cannot be embedded in another syllable." (Pinker and Jackendoff 2005: 10)

> "syllabic structure is devoid of anything resembling recursion." (Bickerton 2000)

To support this idea, Scheer argues that while recursion in syntax is a 'phenomenon', a pre-theoretical fact, in phonology it is merely the result of an analysis of certain

[7] Incorporating the autosegmental approach, phonological representations consist of several parallel strings, each of which is flat.

[8] For some older views see various papers in Safir (1979). Also, see Halle and Vergnaud (1981). A recent survey of 'binary branching approaches' to vowel harmony can be found in Jurgec (2024).

phenomena that are not recursive 'as such' and that can be accounted for without it (and in fact perhaps without any appeal to constituent structure):

> First, the linguistic facts are quite different: nobody has ever seen a recursive phenomenon in phonology. What we have seen are recursive analyses of non-recursive phenomena […] Second, embedding is not recursion, and projection could not possibly be recursion. Alleged recursion in phonology involves embedding, but never of the same type of items, i.e. which have identical domination properties […]. (p. 268)

There are 5 problems with this argument. Firstly, it has been argued that even in syntax there are alternatives to invoking recursive structure (see Paap and Patridge 2014, also referred to by Scheer, and several chapters in van der Hulst 2010c). Secondly, an appeal to recursion and constituency in phonology may lead to accounts that are simply more insightful and perhaps even simpler, and thus in some sense, more explanatory, even though strictly linear analyses *can* account for the facts in the sense of being observationally adequate. My defence of recursivity in syllable structure will appeal to such a line of reasoning, but I would also argue that restrictions on prevocalic consonant clusters in languages such as English strongly suggest onsets as structural units, possibly constituents, while constraints that involve vowels and post-vocalic consonants strongly suggest a rhyme unit (see section 4). Fourthly, an appeal to a recursive analysis of syllable structure may make it possible to dispense with the notion of *foot*, thus allowing for a more economical theory and more explanatory adequacy; see section 6. My fifthly, and most importantly, observationally, it may seem that syntax is recursive in a phenomenological sense, while phonology strikes one as linear. However, making a distinction between recursion being a phenomenon in syntax, but merely the result of analysis in phonology, cannot be compelling, because, observationally, sentences are equally linear as phonology is. All structure that we attribute in both phonology *and* syntax is non-perceptible and thus always and necessarily a matter of analysis. Finally, recursion that involves a unit containing unit of the same type, i.e. be self-embedding recursion, is arguably a specific case of recursion. Self-embedding recursion is simply a logical consequence of the possibility to combine units that are already the result of the combining. In this sense, a syllable that combines a consonant (or complex onset) with a rhyme that consist of a vowel and a coda is already an instance or recursion, albeit one in which a head combines with an *adjunct* (the onset). In an adjunction structure, the label of the host is projected to the node of the combination. Scheer argues that projection is not a form of recursion, which he limits to recursion in syntax that involves combining head with a *complement* which allows this complement to expand into full phrase. In section 4, I will argue that precisely this kind of recursion occurs in syllable structure as well.

I agree with Scheer that while recursion in syntactic analyses is apparently hard to avoid, it is much easier to show that we do not need it in phonology (along with not needing constituency). Arguably, one must always resort to the simplest analysis. In this context, Lasnik and Uriagereka (2022) provide a case for the claim that certain patterns in syntax (such as nouns being preceded by multiple adjectives) are more adequately represented in terms of a simple non-binary structure rather than in terms of a structure

with multiple layers of embedding. This suggests that learners can choose different formal grammar types within a grammatical module, using a less powerful grammar where this is possible or even desirable. However, perhaps we can make a cases for the possibility that learners may choose a more powerful format even when this is not strictly necessary if this leads to a more explanatory account, taking in all the evidence. Perhaps sometimes the simplest way is not the best way. To support this possibility, I suggest the following analogy. If one needs a ladder to climb to the roof, which cannot be reached in any other way, why would one not use the ladder to enter a window on the second floor, even though they could use the more treacherous drainpipe?

To conclude this section, I provide another angle to support why constituency (and recursion) in phonology cannot be excluded. If humans can wrap their mind around constituent structure and recursion in syntax, it is a matter of *cognitive economy* that the mind will use the same 'bag of tricks' in all mental modules, at least potentially, not even just in their mental grammar, but also in other mental modules; see Carruthers (2006) who supports the idea that different modules likely tap into the same organizational principles. Structures that are comparable to what we seem to need in syntax are ubiquitous in human culture. This does not mean that constituent structure and the special case of 'A-within-A' recursion must be used to the same degree in all modules. While syntax caters to conceptual-semantic substance (which, I will assume, is uncontroversially hierarchical and recursive), this module will appeal to these properties as much as possible to achieve maximal isomorphy and transparency between conceptual structure and syntactic structure. Phonology, on the other hand, caters to 'phonetic substance' (which is mostly linear and, importantly, rhythmic). As argued in van der Hulst (2010a) and Den Dikken and van der Hulst (2020), multiple embedding creates structures that fail to capture the rhythmic structure of speech. Therefore, phonology curtails recursion in order to avoid rhythmic lapses. This point is discussed in more detail in section 6.

An argument that one could make against the notion of cognitive economy is that the notion of module itself might suggest that no similarities are expected, because each module will have a design that optimizes its ability to perform a certain function (as emphasized in the Evolutionary Psychology approach; see Tooby and Cosmides 2005) who use the analogy that just like the parts of a Swiss Army knife differ for a reason, we would expect that mental modules also differ. Staying with the bounds of language, this assumption is counterbalanced by the fact that analogies between phonology and syntax, to which we turn in the next section, are quite convincing.

4 The Structural Analogy Assumption

The idea that syntax and phonology have a similar architecture, both in terms of derivational and representational aspects, has been heuristically used and explicitly proposed in a long line of work in linguistics. Van der Hulst (to appear b) provides a historical background to the recurrent discussions about potential analogies, or lack thereof, within the pre-generative and generative approaches. As shown in Goldsmith and Laks (2000), from a historical point of view, analogies between phonology and syntax have often resulted from the latter following the lead of the former, providing examples

from the structuralist period, especially noting the influence of the role of phonological feature theories on feature theories in syntax and semantics. With the emergence of generative grammar, Chomsky also clearly pursued analogies by modelling his syntactic theory on phonology theory, adopting a distinction between a deep, or underlying, structure and a surface structure in both modules which are mediated by an extrinsically ordered set of transformations, simply called *phonological rules* in phonology.

As generative syntactic theory developed, this analogy was undercut by the eventual elimination of transformations, a trend that was not followed in *mainstream* generative phonology which led Bromberger and Halle (1989) to emphatically state that 'phonology is different', primarily in needing a set of extrinsically ordered phonological rules. Syntax and phonology were thus developed on the basis of research by different linguists, who were not necessarily in agreement with the idea, let alone with the expectation that there should be a close correspondence between phonology and syntax. As a result, rather different and diverging varieties of both modules emerged in the linguistic literature, culminating in a radical conceptual decision in the Minimalist Program which places phonology outside the innate core of human language ability. Indeed, within the Minimalist approach, phonology is seen as an evolutionary afterthought that emerged to allow externalization of syntactic structures for the purpose of bonding and communication. In this view the organization of phonology is solely attributed to so-called 'third factors' (see Samuels 2009), i.e., to cognitive systems that are not specific to language, often shared with other animal species, or factors that are anchored in language use or even 'natural laws'.[9] In an approach called 'Emergent Phonology' (Archangeli and Pulleyblank 2022), the idea is that children can learn the phonology of their language based only on general learning strategies, with no appeal needed to innate aspects that are specific to human phonology. These various views have thus returned to an empiricist take on the acquisition of phonology.

The seed for the separation between phonology and syntax, despite the early parallels between them, was actually present in generative grammar from the start, because syntax was always regarded as the central module of grammar, and eventually as the only module of grammar. This encouraged the expectation that there is no reason to expect that the organization of syntax is in any way paralleled by the organization of phonology.

To counter this line of thinking, one would have to question the syntactico-centric view, which is of course what has motivated Jackendoff (2002)'s parallel architecture model, which recognized syntax and phonology (as well as semantics) as independent generative systems, each responsible for the grammatical wellformedness of one of the three layers of linguistic expressions. This view of the organization of the grammar undermines the expectation that phonology is not rooted in the same innate cognitive capacities as syntax (whether specific to language or not), and it may even suggest that structural analogies are to be expected, even though this possibility is not directly addressed in Jackendoff's work.

Nevertheless, in current mainstream generative quarters very general analogies are agreed upon. In both phonology and syntax, there has to be a finite alphabet of basic units, the atoms of structure, which are organized in wellformed structures following a finite set of rules or constraints. As long as at least some syntactic transformations were

[9] For a discussion of 'third factors', see chapter 5 in van der Hulst (to appear c).

deemed necessary, structure-changing rules were needed in both modules that could change the 'base-generated' structures to conform with a finite set of 'output filters'. Arguably, internal merge is a transformational mechanism. In both domains, a featural analysis of basic units has remained the norm and it would seem that feature geometric approaches in both phonology and syntax are indeed very analogous (see Clements 1985; Harley and Ritter 2002). Finally, it is clear that the notion of *locality*, curtailing apparent long-distant relations, has long played a key role in both syntax and phonology (Koster 1981; Jensen 1974). These various analogies are discussed in detail in van der Hulst (to appear a).

Let us here consider how phonology and syntax might differ in how they account for apparent non-local relationships. In a multitiered theory of phonological structure, apparent non-local relationships, can be represented as local with reference to specific tiers. For example, in van der Hulst (2018) I analyse vowel harmony in terms of lateral head-dependent relations that refer to the structural level of syllable heads. This stands in contrast to accounts of apparent non-local relations in syntax that crucially refer to the hierarchical constituent structure (as, for example, in cyclic *Wh*-movement which explains long distance relations between the *Wh*-phrase and its original site). Can this be used as an argument to support that phonology and syntax *do* differ fundamentally in how their representations are structured. Before we jump to such a conclusion, it is important to take note of a proposal for multitiered representations in syntax to account for non-local syntactic relations (van Riemsdijk (2021). What this means is that in some cases postulating multiple tiers may relieve reliance on constituent structure; thus, using one does not make using the other superfluous.

What this example illustrates is that when looking for analogies between syntax and phonology, we should not only focus on approaches in so-called mainstream approaches. The conclusion that phonology is fundamentally different from syntax, because it needs ordered rules, was not accepted by all phonologists, many of whom tried to dispel extrinsic ordering during the 1970s (see for example Koutsoudas et al. 1974 and the natural phonology approach of Vennemann 1974 and Hooper 1976; Declarative Phonology, Coleman 1995). Here we must also mention the development of Government Phonology (Kaye et al. 1985, 1990; Ritter 1995, 2022). The originators of this model set as their specific goal to develop an approach that was analogous to the Government-and-Binding model of Chomsky (1981), incorporating principles such as the Empty Category Principle (ECP) and the Projection Principle and mechanisms called government and licensing. The ECP played a key role in accounting for vowel-zero alternations which invokes the notion of the empty nucleus which would appear as silent if governed. The idea that postulating covert units needs to be constrained by principles that restrict their distribution to where they are locally governed by an overt unit was clearly shared by using covert units in both syntax and phonology. The Government Phonology approach was meant to offer a rule-free phonological theory in which the phonetic interpretation that characterizes something close to the phonetic surface had access to a single level of representation; see Ritter (2022) for an overview of this model, as well as later developments. Perhaps ironically, as we have seen in this chapter, subsequent developments in Government Phonology, while maintaining a central role for government and licensing relations, moved away from syntax in promoting phonological representations as 'flat' strings.

The most in-depth review of syntax-phonology analogies is Anderson (1992; see also Anderson 2006, 2011abc, 2022ab), who promotes the 'Structural Analogy Assumption', a notion that forms a cornerstone of the Glossematics theory proposed by Louis Hjelmslev (1943). Here I restate Anderson's Structural Analogy Assumption (SAA) in an abbreviated form:[10]

(5) The Structural Analogy Assumption (SAA)
The same structural properties are to be associated with syntactic and phonological representations except for differences which can be attributed to the different character of the alphabet involved

We must note that establishing analogies is unrelated to whether we adhere to a constituent-based approach or a dependency-based approach.

What do we mean by 'structural properties? The details of course depend on the model that is followed and specifically, whether we deal with a constituent-based or a dependency approach. Generalizing over kinds of theories, we can here mention as key properties hierarchy, head-dependency and perhaps binarity.

Here I first discuss the notion *headedness* which, in its most general form, results from a general property of complex structures, which is that when units are combined there will always be an asymmetrical relationship between them such that one unit, called the head, is characteristic of the combination, and as such obligatory, with the other unit being the dependent. From this is follows that when syntactic units are combined to form phrases and sentences, headedness is automatic consequence. This immediately suggests that headedness must also be a property of phonological representations, given that one way or another such representations display complexity that results from combining basic units or combinations thereof.

The idea of headedness in syntax has a long history. Given that no linguists would ever say that sentences are random combinations of words, it has long been proposed that the non-randomness of combinations involves *dependencies* between words such that certain words could not occur unless being dependent on (or governed by) another unit. In this view a sentence is exhaustively parsed in a set of dependency relations with ultimately one unit not being dependent on anything else, the head of the sentence. In the 20th century this understanding of what makes a sentence wellformed have given rise to various kinds of a Dependency Grammar model (Tesnière 1959; Hays 1964).

Most syntacticians have been trained in the early tradition of Generative Grammar in which sentence structure would be represented in terms of a constituent structure (built by phrase structure rules) and they have come to learn about headedness when Chomsky added this notion to constituent structure, identifying one word as the head of each phrase which then would project its word category label ('X') to the phrase label (XP). This resulted in a cross-categorial X-bar structure, in which the head could have two dependents, a complement (which would be selected by the head) and an optional specifier. While Anderson (2006) questions the cross-categorial validity of a uniform phrasal structure (this questioning syntax-internal analogy), the details of phrasal structure have changed over time, with some questioning the notion specifier (thought to

[10] For a detailed discussion of syntax/phonology analogies, see van der Hulst (to appear a) on which the present section is in part based.

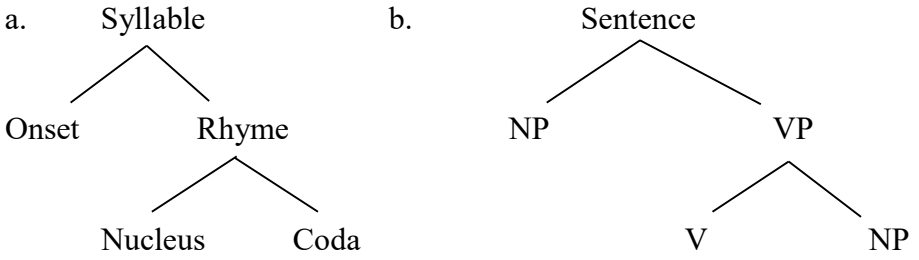
be non-phrasal) and other pointing to a distinction between phrasal complement (obligatory) and phrasal adjuncts (optional), the notion of headedness and some phrasal being dependent on heads has remained. This chapter's task is not to review these developments, although a distinction between types of dependents that differ in terms of how close they are related to the head has also remained, even in Minimalist descendent of generative syntax. An important question is how we know which unit in a combination is the head and thus projects its label to the constituent. This has raised the issue of 'labelling' that has been central in Minimalist approaches. In the dependency approach of John Anderson, syntactic headedness correlates with the *semantic salience* of a unit, thus adopting the view that syntax is grounded in semantics. Such a view is impossible in generative, constituency-based approaches which proclaim the autonomy of syntax.

Meanwhile, headedness also came to be acknowledged in phonology. Here, we must separate its usage in Dependency Phonology (originating in Anderson and Jones 1973, and fully worked out in Anderson and Ewen 1987). As per the SAA, headedness in phonological structure is expected. But more than that, headedness has found useful applications in this domain, a well-known example being that vowels qualify as heads of syllables, being the obligatory segment types in most cases. Several recent writers, such as Carr (2006) and Tallerman (2006) do not see that the notion head in syntax and phonology as involving a real analogy. However, this view results from a syntax-biased understanding of heads which, in the words of Carr, is semantically based (despite the autonomy of syntax). Therefore, he reasons, there can be no heads in phonology because phonological units do not have meaning. However, Anderson, while certainly seeing syntax as grounded in 'semantic substance', associates headhood with a notion 'salience', which is not committed to a specific type of grounding. For him, phonological units, which are grounded in 'phonetic substance' that are heads are *perceptually* salient due to properties such a high sonority.

Independently of Dependency Phonology, Liberman (1975) and Liberman and Prince (1977) proposed a model of phonological structure (called 'metrical'), a crucial part of which was that syllables group into binary constituents called feet. In such grouping one syllable was labelled 'S(trong)', the other W(eak), indicating relative prominence, or indeed perceptual salience. The S/W labelling was subsequently replaced by reference to the strong syllable as the head of the foot. In this approach feet were grouped in larger units, such as the prosodic word and this eventually led to recognizing a prosodic structure for the whole utterance, with headedness being marked at each level in this structure. Headedness also played a role subsegmentally, first in Dependency Phonology and later in Government Phonology and eventually in other segmental models in one way or another (see Ewen 1995 for a general discussion of phonologically headedness). It should be clear that with an appropriately abstract characterization of what is means to be a head (i.e., relative salience) the view that there is no analogy between heads in syntax and phonology seems misguided.

Turning now to the structure that phonological units enter into, various early proposals noted analogies between the internal structure of syllables, here assuming an onset/rhyme division and a division between nucleus and coda in the latter (5a), and the structure of a 'simple' sentence (5b) (Kuryłowicz 1948; Pike and Pike 1947; Fudge 1969, 1987; Blevins 1995). This analogy was later identified as one between syllable structure and phrasal structure in general.

(5) a. b.



The central thesis of van der Hulst (2005a, 2010a), which is further developed in den Dikken and van der Hulst (2020) in the 'One Syntax for All' program, assumes that phonology and syntax have recourse to the same computational system, which includes structural notions such as hierarchical structure, binarity, headedness and self-embedding recursion.[11] In fact, this program was inherent to Government Phonology as it was originally conceived (see Ritter 2022). It is important to emphasize here that the oneness is not understood in the sense of Nasukawa (2015) who pursues the idea that phonological structure and syntactic structure do not only employ the same structural principle, but are also built in sequence, thus forming one hierarchical structure that ranges from the smallest units, phonological elements, to the largest syntactic objects. For Den Dikken and van der Hulst, as for Anderson, syntax and phonology form different parallel planes.

Before we examine the analogies between syllabic structure and phrasal structure further, another dimension of the analogy issue must be taken into account. As pointed out in van der Hulst (to appear a), the expectation of structural analogy in a broader sense is supported by what Abler (1989) calls the *Particulate Principle*. Abler describes *particulate systems* as systems in which a finite set of discrete units are combined into hierarchical structures. He refers to such systems as 'self-diversifying systems' or 'Von Humboldt systems', after the latter's famous characterization of language as a system that makes infinite use of finite means. The Particulate Principle, according to Abler, characterizes not only language, but all physical systems, including chemistry, physics, and genetics, and also mental systems. In all these systems, we start out with a finite set of primitives (elements, DNA bases) which are combined in increasingly complex structures. In language, he says, the Particulate Principle applies twice, both at the level of phonology and at the level of syntax. For further discussion of his and related views, I refer to van der Hulst (to appear a).

If we claim that the basic architecture of both syntax and phonology falls within a much wider class of complex systems, it would seem to follow that the fundamental organization of grammars can be attributed to third factors, which undercuts the idea that syntax would be the sole content of UG, suggesting that UG is in fact empty. Indeed, the particulate principle constitutes a prime example of a third factor in the design of language. This is consistent with the views of John Anderson (see Anderson 2011abc, 2022ab), who argues that all properties of language can be attributed to more general

[11] Further analogies could be found in the featural analysis, including the issues of valency (binary or unary features), underspecification and 'feature geometry'.

cognitive principles. It would seem that not much has remained of the original Chomskyan claim about an innate structure for language.

Here I offer what I think is the best argument for why recursive syllable structure is expected. In syntax, the most important source of recursion is that heads of phrases can take, as complements, full (maximal) phrases. If, then, we accept the idea that syllables have a structure that is analogous to syntactic phrases with the vowel as their head, we must identify the 'coda' position as the complement, which would then create the possibility of the same kind of recursion in phonology as we find in syntax. This kind of recursion which does not result from adjunction, would qualify as true, self-embedding recursion in Scheer's view.

Why would one say that the coda is like a complement? A key argument, due to John Anderson (e.g., 2011c) comes from languages like English (and other Germanic languages) in which, as has traditionally long been noted, so-called lax vowels must be followed by a coda consonant: /bɪ/ is phonologically ungrammatical, although /bi/ is not (cf. Trubetzkoy 1939 who referred to such vowels as 'checked'). As pointed out by Anderson, one could say that lax vowels are like transitive verbs in that they call for a complement. In constituent terms, that lax vowels have a subcategorization frame [__C]. In the notation that was used in (3), lax vowels have the property (V/C): they look for a C to make a V (i.e., a 'rhyme'). This then establishes the idea that the coda position is a complement of the head vowel. Consistent with this, we could say that lax vowels select not just for a consonant, but for a following *syllable*, which is the maximal phonological category of which the vowel is the head. Just like recursivity in syntax is made possible because complements can be phrases, phonology is recursive in allowing syllables in the position that can also be filled by a coda consonant. The situation in phonology is perfectly analogous to that in syntax. One might say that this argument collapses if one were to say, as Scheer does, that there are no syllables to begin with, but this might not be so if dependency structures *can* be recursive and, moreover, Scheer's own version of Government Phonology may be a dependency-based theory. I will make this point in section 7.

6 What does recursion in syllables give us?

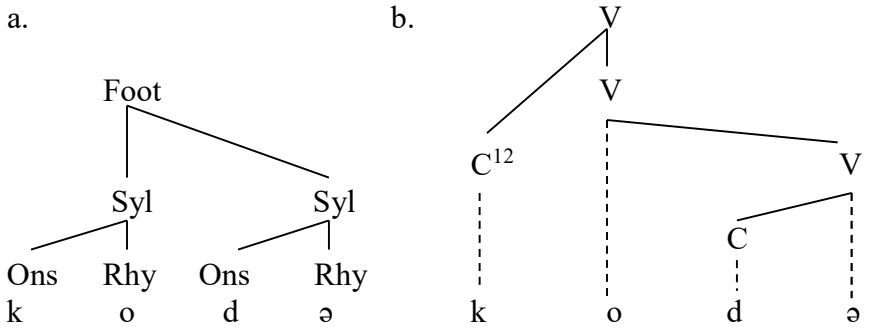
In this section, I recapitulate (with some modifications) the proposal made in van der Hulst (2010a) that there is recursivity in syllable structure, based on the idea that the coda position (as a complement of the vowel, or nucleus) is the site for recursion.

Van der Hulst (2010a) proposed that we can eliminate the notion *trochaic foot* by allowing syllables to contain syllables. Scheer (2023) discusses and rejects this proposal, as well as related proposals that have argued for recursion in syllable structure. I refer to van der Hulst (2010a) for a review of these proposals and to den Dikken and van der Hulst (2020), who expand the proposal in van der Hulst (2010a).

Van der Hulst's (2010a) proposal takes the idea that syllables have a head-dependency structure one step further by following Anderson in comparing the coda postilion to the complement position in phrasal syntax and then taking this still one step further by showing that the complement position is a site for recursion, as it is in phrasal syntax. Here the details differ slightly from both earlier articles to notionally emphasize

that syllables are maximal (lexical) phonological phrases. Compare the bisyllabic representation in (7a) with the representation in (7b) for the word *coda*:

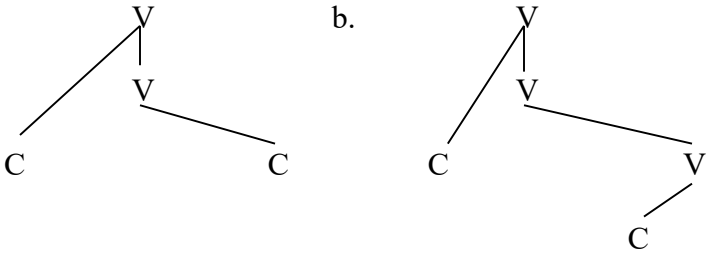
(7) a. b.



In (7b) a trochaic foot is a syllable that contains another syllable in the complement position. This is precisely what has been repeatedly mentioned as something that does not occur in phonology. We can now reformulate the foot-binarity constraint in terms of head selecting a dependent syllable. This requirement is obligatory if a language does not allow degenerate feet and a constraint that requires words to be minimally bisyllabic would be a specific instance of this requirement.

Why would we prefer (7b) over the traditional (7a)? A first thing to note is that (7b) would directly capture the often-observed equivalence between a closed syllable and a branching foot (cf. McCarthy and Prince 1986). In the present proposal, the two objects shown in (8) are *structurally identical*, especially if we were to represent the coda consonant in (8a) being an empty-headed syllable:

(8) a. b.



Van der Hulst (2010a) mentions poetic rhyming in support of (7b). In a 'feminine rhyme' (e.g., *coda – soda*), the initial consonant of the foot falls outside the rhyming unit which indeed is a unit in (7b) but not in (7a).

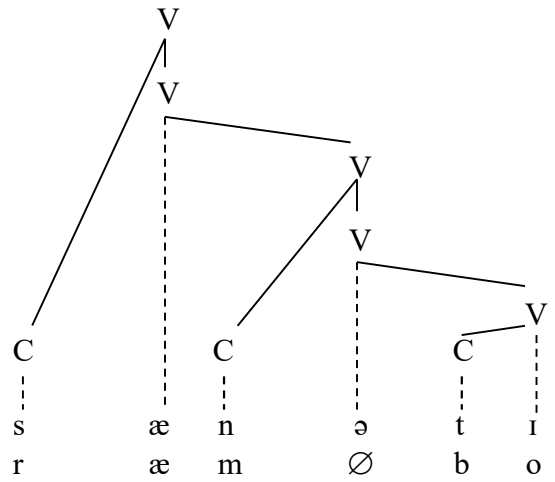
The advantage of getting rid of the notion foot, is that feet are not necessary for an account of word stress if clear distinction is made between primary stress and rhythmic stress. For a defense of this view, I must refer to van der Hulst (2012, to appear a) where it is shown that feet are not necessary, but also that there is no conceivable theory of foot structure that can straightforwardly account for the variety of bounded stress systems. In this connection, it is relevant that in some languages the foot structure that is postulated

[12] Den Dikken and van der Hulst make a proposal to bring iambic feet within the purview of syllable structure. In van der Hulst (2023), I explore the possibility that onsets allow for recursion. Here I suggest that this could take the form of placing the weak syllable as an adjunct of the onset.

to account for segmental regularities (involving cases of allomorphy or phonotactic restrictions) do not account for (surface) rhythm which had led to proposals that two types of foot structure are required. If rhythm is accounted for in the phonetic implementation, we do not feet at all, if the segmental regularities can be dealt with an appeal to recursive syllables. I must refer to van der Hulst (2012) for discussion of such cases and references.

Let us now ask whether syllables that are contained in syllables can contain syllables, i.e., recursion of the second degree. The structure in (9) shows that the string *vanity* must be parsed as one syllable to account for the fact that it rhymes with *sanity*:

(9)



It would seem that in this case too, rhyme (*sanity – vanity*) supports recognizing the unit /ænətɪ/ as a structural unit. Here I have assumed that *rambo* type words in which the /m/ and the second 'syllable' /bo/ seem to compete for the recursive coda position have the same structure as 'trisyllabic' words, as shown in (9), and indeed, *rambo* rhymes with *mambo*.[13] Note that this proposal makes the notion of foot structure superfluous, including trisyllabic or so-called 'layered feet' (Martínez-Paricio and Kager 2021), as a phonological category.

It might be argued that the structures in (7b), (8), and (9) are not really recursive. A key point here is that true recursion implies that each instance of the recursive node has the same distributional and other properties. According to Marcel den Dikken (pc.) this requirement has not been made in syntax where subordinate clauses do not have the same distributional and internal properties as root clauses. Apart from that point, it is not clear that the embedded instances of syllables in these representations have distinct distributional properties when compared to the 'matrix' syllable, although it is true that they may have more limited phonotactic properties in that embedded syllables may have a less complex structure. This, however, reflects a general pattern of asymmetries in dependency structures in which dependent units are typically simpler than their heads (and, crucially never more complex than their heads); see Dresher and van der Hulst (1998). Perhaps, similar asymmetries obtain in the domain of syntax. In the case of so-called recursive phonological words, the argument has been made that larger instances of

[13] Den Dikken and van der Hulst (2020) offer an analysis of syllable recursion that enhances the analogies between phonology and syntax, among others by invoking an analogue to the notion 'little vP'.

the alleged phonological words may have significant different properties, for example, in terms of stress properties or phonological rules, that lower or the most embedded instances miss, leading to the conclusion that the higher instances should be analyzed as different phonological categories (see Miller and Sande 2021 for a recent discussion). Here we must take into account that the argument that alleged recursive categories have distinct properties, always seem to regard cases of adjunction and it may be that for this reason lower and higher units can have different properties.

6 Why there is less recursion in phonology than in syntax

Scheer (2023) voices the following objection to postulating recursion in phonology:

> […], alleged cases of phonological recursion always have limited depth […]. (p. 268)

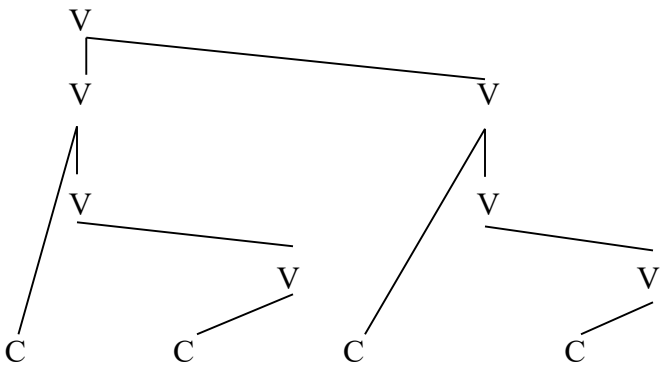
Accepting that recursion is available to phonology (because it is available to the human mind), does not entail that phonology must display the same amount of recursive structure as morphosyntax does. As already mentioned earlier, the kinds of structures that are employed in both modules do not exist in a vacuum, but rather are formed to accommodate the substances that these structures are grounded in.

Firstly, Den Dikken and van der Hulst (2020) argue that syntax displays more recursive structure than phonology due to the lack of a parallel to morphosyntactic functional categories in the latter. I will not elaborate on that point, but of course, the question as to why only syntax has functional categories and phonology does not (if this is indeed the case) deserves more discussion. However, there is an additional reason for why recursion in phonology is less pervasive, already offered in van der Hulst (2010a) and also provided in Den Dikken and van der Hulst (2020). If we accept the fact that semantic, conceptual structure (Anderson would say 'conceptual *substance*') is inherently recursive, we expect morphosyntax to be faithful to this semantic, conceptual structure as much as possible. In this way, syntax provides a transparent window on what sentences mean. Certain factors that cause syntactic displacements of various kinds entail a lack of isomorphism, creating opacity due to mismatches between morphosyntactic structure and semantic-conceptual structure, which testifies to the relative autonomy of the two modules. Phonological structure accommodates phonetic-perceptual substance, which arguably is not inherently recursive in the way conceptual structure is.

This may lead to a view that phonology is 'flat', perhaps only displaying recursion when expressions are morphosyntactically structured. But recursion in phonology is limited even in this case. As shown in Giegerich (1985), there is a 'flattening force' which causes dysrhythmic structures that contain lapses (sequences of weak units, 'SWWW…') to flatten by breaking them up into smaller rhythmic units (i.e., SW SW). We should note that the same flattening forces that limit phonological recursion in morphosyntactically structured expressions may also prevent level 3 embedding in monomorphemic units. While it is possible to argue that rhythm is accounted for in the phonetic implementation (see van Hulst 2012, 2014), it might still be the case that a sequence of four syllables is preferably not structured in terms of a syllable with 3 layers

of embedding, because such a structure is insufficiently faithful to the rhythmic structure of the phonetic substance which will prevent a so-called rhythmic lapse SWWW. To keep the relation between phonological structure and phonetic substance as faithful as possible, a sequence of four syllables will divide into two syllables each containing an embedded syllable:

(10)



Beyond the 'magic number' 3, unbounded recursion gives in to rhythm.

Needless to say, recursion in syntax is also limited, curtailed by the fact that recursion beyond three levels becomes as good as incomprehensible (see Karlsson 2007) which may correlate with limits on recursion in the conceptual structure. There is no difference here: in both syntax and phonology the formal possibility of recursion is limited by properties of the substances that they cater to.

7 Is strict CV theory a dependency model?

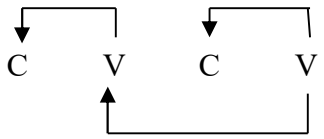
I have suggested that Scheer's theory falls with the realm of dependency-based theories.[14] This is supported by the following quote from Scheer (2023: 55):

> Lateral relations are thus an instance of a dependency relationship, though a competitor of the arboreal description of syllable structure. As such, their application mechanically leads to the elimination of trees.[15]

Scheer does not consider the possibility that a theory that relies on lateral relations is in fact a form of dependency phonology.[16] He characterizes Dependency Phonology as a theory that relies on 'arboreal' representations but the tree-like graphs in Dependency Grammar approaches are representations of dependency relations and not of constituency. The resemblance between dependency graph and constituent structure graphs is superficial. Perhaps then Scheer overemphasizes the difference between Strict CV and Dependency Phonology. Concretely, let us consider a sample representation in a Strict CV model of the word *city* (see Scheer and Cyran 2018):

[14] Anderson himself would likely not characterize strict CVCV theory as a form of dependency phonology.
[15] We have to bear in mind that when Scheer uses the term 'arboreal' he means constituent-based.
[16] Anderson himself would likely not characterize strict CVCV theory as a form of dependency phonology.

(11)

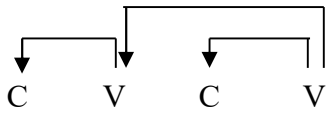


Vowels license their 'onsets', which is expressed above the CV string. At the same time, there is a licensing relation between the two Vs. In (11) the arrow points to the dependent. This can be confusing if we want to compare Strict CV to Dependency Phonology because in the very first versions of dependency grammar, the arrow points to the head:

(12)

As (12) makes clear, there is no need to represent these relations in different 'planes' as in (11). We can represent (11) as (13):

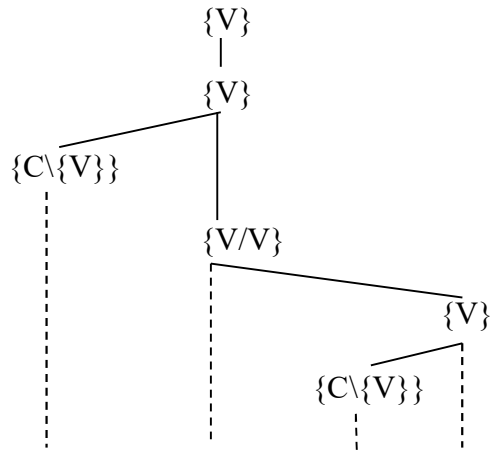
(13)



Perhaps then Scheer overemphasizes the difference between Strict CV and Dependency Phonology.

We must now return to Scheer's point that there can be no recursion in phonology because there is no constituency in phonology. This point loses its force if (a) lateral phonology is a form of dependency phonology and (b) we can furthermore show that dependency-based representations can be recursive. While this issue deserves more exploration, I here offer a dependency structure that applies the same formalism that was used in the dependency structure in (4) that represents the word *city* as consisting of one syllable that contains another syllable, in a manner that is identical in all relevant respects to the representation in (7b):

(14)



s ɪ t i

Here we must give up on the idea that /t/ is ambisyllabic, but I would argue that ambisyllabicity is a phonetic property that arises in the phonetic implementation of phonological structures. In any event, the conclusion is that a dependency model, including Strict CV, if it is one, does not preclude recursion just because it rejects constituent structure.

It is important to note that the possibility of recursion exist in John Anderson's construal of the dependency formalism which in both syntax and phonology incorporates a distinction between dependency as adjunction and dependency as subjunction, thus acknowledging that there are two types of dependency with respect to the head. As stated with reference to (4), in the latter case of subjunction an element is head of two successively more inclusive constructions. Assuming that this distinction has no analogue in Scheer's lateral theory, there would be no possibility for recursion in his lateral model.

9 Conclusions

In this chapter I have explored (a) the relationship between linear order and hierarchical structure and (b) the occurrence of recursion in phonology. It has often been observed that we do not need both. In current versions of generative syntax, linearization is derived from hierarchical structure. In many approaches to phonology, syllable structure is assigned to the linear string of segments, thus seeing hierarchical structure as derived. The Strict CV model assigns lateral relations that make syllable structure superfluous, but these relations are also assigned to a linear string of segments, just like syllable structure in in other models. All these approaches thus essentially maintain the model developed in Chomsky and Halle (1968), assuming that the phonological representation of words is stored in the lexicon as a flat string, even when one would argue that the lexicon also harbors the predictable syllable structure or lateral relations in a 'full entry' perspective. Dependency Phonology has offered an alternative to constituent-based representations in phonology, and we should not be misled by the fact that dependency relations can be graphically represented with tree-like, arboreal graphs that often look very much like constituent structures (although not so much in the notation that was used in 12). I have suggested that Strict CV with its lateral head-dependency relations is probably best understood as a form of dependency phonology, which is not to deny that both approaches are non-homogenous and proponents in each 'camp' have developed different variants.

As for recursion, I have argued that the occurrence of syllables inside syllables is expected on various grounds, both conceptual/theoretical and empirical. I have offered the argument from Cognitive Economy to support why there is no reason to preclude the use of recursion in phonology. The argument for analyzing codas as complements, that allow a maximal category (i.e., a syllable), stands on firm theoretical grounds. Thus far, I have only been able to find one empirical argument based on rhyming practices for why a traditional trochaic foot can be fruitfully analyzed into a syllable sitting inside a syllable, in the coda position, which is formally parallel to the complement position in syntactic phrase structure that is considered to be the major site for recursion to arise. Perhaps

more importantly, syllable recursivity replaces metrical foot structure, given that rhythm can be relegated to phonetic implementation. I have argued that constrains on foot structure, such as mandatory binarity and minimal word constraints can be cast in terms of head syllables requiring a dependent. It is possible that if we take a renewed look at other phonological phenomena, phonologists may come to realize that there are other types of data that can be fruitfully analyzed with an appeal to phonological recursion within the syllable or even within the segmental structure (see Nasukawa 2014, 2017, 2020; Pöchtrager 2015, 2020).

A question that needs further investigation is whether the linear order of segments that seems to be implied in dependency or constituent structures can be predicted from these structures. This possibility is explored in Anderson (1987).[17] The basic argument was that, given a dependency organization, linearization can be derived from general sonority sequencing generalizations.[18] If the importance of linearity in phonology can be thus reduced this implies an interesting twist to the debate if we can conclude that phonology is neither flat nor linear, at least in some domains.

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[17] See Canalis (this volume) for an exploration of this idea in the context of metathesis phenomena, which also are discussed in Apostolopoulou (this volume). Nasukawa (this volume) also defends the idea that linearization can be derived from asymmetric phonollgical structure of phonological primes in his Precedence-free Phonology model.

[18] See Krämer and Zec (this volume) and Hakimov (this volume) for discussion of the role of sonority in syllabic organization.

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