




Research article

The Sonority Sequencing Principle and the Reanalysis of English S-initial Consonant Clusters

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| ARTICLE | INFO | ABSTRACT |
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| History. Received: 28 March, 2026 Revised: 16 May, 2026 Published: 05 June, 2026 | | This paper argues that this apparent violation necessitates a reanalysis of English syllable structure. Drawing on extensive phonological literature and syllabification evidence, we propose that the initial /s/ in these sequences should not be considered a part of the core syllable onset. Instead, it is best analyzed as an adjoined extra-syllabic segment, appended directly to the syllable node. This revised model, which treats the true onset as the well-formed /pr, tr, kl/ clusters, fully preserves the universality and explanatory power of the Sonority Sequencing Principle. We provide empirical support for this reanalysis through an examination of word-medial syllabification, compound formation, and re-syllabification patterns in English. By resolving the long-standing /s/ paradox, this study offers a more coherent and empirically adequate model of English syllable structure, reinforcing the SSP as a core tenet of phonological theory. |
| Keywords. Syllable Structure; Sonority Sequencing Principle; Consonant clusters; Extra-syllabicity; Adjunction; English phonology; S-initial clusters; Phonotactics | | |
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1. Introduction

The syllable, despite its intuitive accessibility to native speakers, remains one of the most complex and debated units in phonological theory. Its significance, however, is undeniable. The syllable serves as a crucial organizing principle for speech sounds, providing the structural foundation upon which phonotactic constraints, phonological processes, and prosodic phenomena are built. As noted by Blevins (1995), the syllable is not merely a convenient label but a theoretical necessity for achieving explanatory adequacy in phonology. English, with its relatively complex phonotactics, provides a rich empirical domain for investigating syllable structure. Three fundamental motivations underscore the indispensability of the syllable in phonological analysis, and English offers compelling evidence for each.

First, the syllable provides the most general and explanatory domain for stating a language's phonotactic constraints. Rather than listing which individual phonemes can or cannot follow each other in a linear sequence, phonologists can refer to positions within the syllable (onset, nucleus, coda) to capture generalizations. For instance, the constraint that /h/ can only appear in the onset of a stressed syllable in English (as in *hotel* [hoo'tel] but not in *vehement* ['vi:.ə.mənt]) is a syllable-based generalization. Similarly, the fact that /ŋ/ can appear in the coda (sing) but never in the onset is a statement about its distribution within the syllable.

Second, the syllable defines the application domain for a wide range of segmental phonological rules. Allophonic variations, such as the aspiration of voiceless stops in English, are conditioned by their position within the syllable. A voiceless stop /p, t, k/ is aspirated when it occurs as the sole member of a stressed

syllable onset (e.g., *pin* [p^hm]), but it is unaspirated when it follows /s/ in a complex onset (e.g., *spin* [spɪn]) or when it is in the coda (e.g., *lip* [lɪp]). This pattern is elegantly captured by referring to syllable structure: aspiration applies to stops in a “strong” onset position.

Third, the analysis of suprasegmental phenomena, such as stress, tone, and intonation, necessitates the syllable as a fundamental unit of prosodic organization. Stress rules, for example, often refer to syllable weight, which is determined by the structure of the rhyme. A syllable with a branching nucleus (a long vowel or diphthong) or a coda (a consonant closing the syllable) is considered “heavy” and attracts stress in languages like English (e.g., *torrent* vs. *ro' bust*). The syllable is thus the lowest level of the prosodic hierarchy (syllable < foot < prosodic word), making it indispensable for any account of metrical phonology.

These motivations extend beyond the syllable as a whole to its internal constituents. The consistent behavior of sub-syllabic groups – the onset, the rhyme, the nucleus, and the coda – justifies treating them as legitimate phonological constituents. The conception of the syllable that emerges from the study of English is, therefore, that of a hierarchical unit with an internal, tree-like structure, analogous in its organization to syntactic structure. This hierarchical model posits that the syllable (σ) directly dominates two primary constituents: The Onset (O) and the Rhyme (R). The Rhyme, in turn, dominates the Nucleus (N) and the Coda (C). This structure captures significant generalizations, such as the fact that phenomena like vowel lengthening or shortening typically affect the rhyme as a whole, rather than the nucleus and coda independently (Gussenhoven & Jacobs, 2017).

1.1 Research Methodology

This study is a qualitative, theory-driven investigation in generative phonology. Its primary goal is not to test a hypothesis through experimental or corpus data, but to resolve a theoretical paradox – the apparent violation of the Sonority Sequencing Principle (SSP) by English s-initial clusters – through structural reanalysis. Specifically, the study adopts a comparative structural analysis methodology, which involves explicitly contrasting two models of syllabification for the same set of phonological data: (1) the traditional flat-onset model, and (2) the proposed adjunction model. The evaluation criterion is whether a given model, in conjunction with a fixed sonority scale (Hu, 2004), generates syllable structures that comply with the SSP's requirement of monotonic sonority rise from the leftmost onset segment to the nucleus. No experimental phonetic measurements or statistical corpus analyses were conducted; the study remains within the domain of theoretical phonology.

1.2 Data Sources and Selection Criteria

The example words used in this study were selected on the basis of two criteria: (1) their status as canonical cases of English s-initial clusters in the phonological literature, and (2) their representation in standard pronunciation dictionaries. Specifically, the core data set comprises English words with initial clusters of the form /s/ + voiceless plosive + sonorant (e.g., *spring* [sprɪŋ], *street* [stri:t], *spleen* [spli:n], *squint* [skwɪnt]) and, as control cases, words with /s/ + voiceless plosive without a following sonorant (e.g., *spin* [spɪn], *stop* [stɒp]). These examples are consistently cited in major phonological works on syllable structure (Borowsky, 1986/1990; Gussenhoven & Jacobs, 2017; Kahn, 1976/2015).

Their phonemic transcriptions and syllabification patterns are drawn from standard reference sources, including *Jones's English Pronouncing Dictionary* (Jones et al., 2011), as well as from established phonological conventions such as the Maximal Onset Principle. Where speaker intuitions about syllabification (e.g., for word-medial *orchestra*) are invoked, they reflect consensus descriptions in the literature rather than novel experimental elicitation. In cases where the literature provides no explicit syllabification, the analysis relies on the author's theoretical intuition, which is explicitly grounded in the principles of onset maximization and SSP compliance.

1.3 A Methodological Note on the Term ‘Empirical’

This study is theoretical, not experimental or corpus-based. In phonology, the term ‘empirical’ can refer to two distinct things: (1) observational data from speech production/perception experiments or language corpora, and (2) the set of well-formedness judgments and structural patterns that a theory must account for. This paper uses ‘empirical’ exclusively in the second sense, referring to the established phonological generalizations and syllabification patterns of English as described in the literature. No new experimental data were collected, and no corpus queries were performed. Consequently, phrases such as “empirical support” in this paper should be understood as “theoretically motivated support derived from established generalizations,” not as evidence from experimental or corpus-based research.

The hierarchical nature of syllable organization naturally leads to principles governing the linear ordering of segments within this structure. The most prominent of these is the Sonority Sequencing Principle (SSP). The SSP is based on the phonetic concept of sonority, which can be broadly defined as the relative loudness or perceptual prominence of a sound compared to others, correlated with the degree of openness of the vocal tract (Ladefoged & Maddieson, 1996/2006). Sounds can be ranked along a universal, though language-specific, sonority hierarchy. A widely adopted scale, such as the one proposed by Hu (2004), ranks segments from least to most sonorous as follows: Voiceless Obstruents < Voiced Obstruents < Nasals < Liquids < High Vowels/Glides < Mid Vowels < Low Vowels.

1.4 Defining SSP Violations: The Plateau Criterion

This study adopts a strict criterion for identifying violations of the Sonority Sequencing Principle within the onset. The SSP requires a monotonic rise in sonority from the leftmost segment of the onset to the syllabic nucleus. Consequently, any instance where sonority does not rise between two adjacent segments in the onset constitutes a violation.

Based on this criterion, two specific patterns are distinguished:

1. **Sonority Reversal:** A pattern where a segment of higher sonority is immediately followed by a segment of lower sonority (e.g., /lt/ in an onset). This is a categorial violation of the SSP.
2. **Sonority Plateau:** A pattern where two adjacent segments share the same sonority level on the hierarchy (e.g., /sp/ or /st/, both members of the voiceless obstruent class). This also constitutes a violation, as the required rise from the left edge to the nucleus has failed to initiate. The plateau, rather than a reversal, represents the minimal deviation from the SSP. In the context of English s-initial clusters, the plateau between /s/ and a following voiceless plosive is the central violation at issue.

This plateau criterion is central to the analysis of English s-initial clusters. Under the traditional syllabification, the sequence /s/ + /p/ (or /t/, /k/) creates a sonority plateau, thereby violating the SSP. The adjunction analysis proposed in this paper is designed specifically to circumvent this plateau by removing /s/ from the core onset.

The SSP leverages this hierarchy to dictate well-formed syllable shapes. It stipulates that: (1) every syllable possesses a single sonority peak, which constitutes its nucleus; (2) the sonority of segments preceding the nucleus (the onset) must rise monotonically towards the peak; and (3) the sonority of segments following the nucleus (the coda) must fall monotonically away from the peak. This creates the characteristic bell-shaped or sonority curve for a canonical syllable. For example, the English word *blink* [blɪŋk] conforms perfectly: the sonority rises from the low-sonority obstruent /b/ to the slightly more sonorous lateral /l/, and then sharply to the vowel /ɪ/; it then falls through the nasal /ŋ/ to the final obstruent /k/.

This thesis aims to analyze a significant and persistent challenge to the universality of the SSP posed by English complex onsets. Traditional syllabification of words like *spring* [sprɪŋ], *street* [stri:t], and *spleen* [spli:n] places all three initial consonants within a single, branching onset. However, according to standard sonority scales, the voiceless fricative /s/ and the following voiceless plosives /p, t, k/ occupy a very low and nearly identical sonority level. Placing them together in the onset creates a sonority plateau, which constitutes a direct and systematic violation of the SSP. This conflict between a universal principle

and the surface patterns of a major language like English has prompted numerous theoretical debates and solutions.

This study proposes a systematic reanalysis of these problematic clusters. Focusing on multi-segment sequences of the type /s/ + voiceless plosive + sonorant (e.g., spr-, str-, skl-, skw-), we will argue that the initial /s/ is structurally distinct from the following two consonants. We will demonstrate that treating this /s/ as an adjoined extra-syllabic segment, attached directly to the syllable node rather than being integrated into the onset, resolves the SSP violation. In this revised model, the true onset is the well-formed cluster /pr, tr, kl, kw/, which exhibits a clear sonority rise from the plosive to the sonorant. This reanalysis not only salvages the universality of the SSP but also provides a more elegant and theoretically supported account of English phonotactics.

2. Literature review

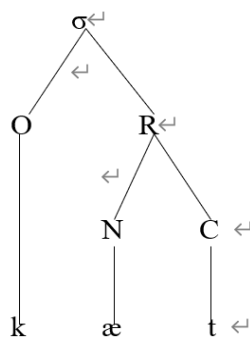
This section provides a comprehensive overview of the theoretical landscape surrounding the syllable and the Sonority Sequencing Principle (SSP). It traces the evolution of syllable representation from linear models to hierarchical and morale frameworks and examines the various formulations and applications of the sonority concept.

Defining the syllable has proven to be a notoriously difficult task. Phonetic definitions, such as the chest-pulse theory or the prominence theory, have struggled to provide a consistent and universally applicable acoustic or articulatory correlate (Trask, 1996/2006). The chest-pulse theory, which links syllables to pulses of air from the lungs, fails to account for syllables with multiple consonants. The prominence theory, which associates syllables with peaks of perceptual prominence, is more successful but still relies on a subjective notion of prominence.

Consequently, the dominant approach in modern phonology is to treat the syllable as a purely phonological unit – a structural constituent that organizes segments and serves as the domain for phonological rules and constraints (Goldsmith, 1990). From this perspective, the syllable is a unit of phonological representation, and its internal structure is a theoretical construct designed to capture generalizations about sound patterns. This section reviews the key models that have been proposed to represent this internal structure.

The most widely adopted model of syllable structure is the hierarchical Onset-Rhyme model. This model posits that the syllable (σ) branches directly into two immediate constituents: The Onset (O) and the Rhyme (R). The rhyme is further subdivided into the Nucleus (N) and the Coda (C). This structure is illustrated in Figure 1 for the English word *cat*.

Figure 1. The Onset-Rhyme Model for [kæt]



- **Onset (O):** The consonant(s) that precede the nucleus. In English, the onset is optional. Phonotactic constraints on possible sequences are most strictly defined for the onset.

- **Rhyme (R):** The core of the syllable, consisting of the nucleus and any following consonants. The rhyme is crucial for determining syllable weight and for processes like rhyme and stress assignment.
- **Nucleus (N):** The obligatory sonority peak of the syllable, typically occupied by a vowel.
- **Coda (C):** The consonant(s) that follow the nucleus.

The Sonority Sequencing Principle is the primary constraint governing the linear order of segments within a syllable. It is grounded in the phonetic property of sonority, which, despite some debate about its precise phonetic correlates (Congrès international des sciences phonétiques, 1991), has proven to be an indispensable phonological concept (Parker, 2002). Sonority is best understood as a composite property related to a sound's intrinsic loudness. Sounds produced with a wide-open vocal tract (like low vowels) are highly sonorous, while those produced with a narrow or complete constriction (like stops) are low in sonority. The sonority hierarchy is a scalar ranking of sound classes based on this property.

This study adopts Hu's sonority scale as its core analytical framework: Voiceless obstruents < Voiced obstruents < Nasals < Liquids < High vowels/glides < Mid vowels < Low vowels (Hu, 2004). This scale is particularly useful because it makes a crucial distinction between voiceless and voiced obstruents, placing /s/ at the very bottom, on par with voiceless plosives /p, t, k/. This parity is the source of the SSP violation in traditional analyses.

3. Analysis of syllable structure of English words

This section applies the theoretical frameworks discussed in Section 2 to the analysis of English syllable structures. It begins by examining well-formed syllables before turning to the problematic case of s-initial consonant clusters. The analysis follows a three-step procedure for each word considered:

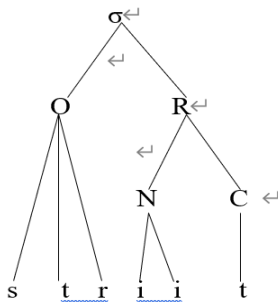
1. **SSP Violation Assessment:** Evaluate whether the sonority sequence from the leftmost segment to the nucleus shows a strict monotonic rise. A plateau or reversal constitutes a violation.
2. **Sonority Level Evaluation:** Assign a numerical sonority value to each segment based on Hu's (2004) scale.
3. **Model Comparison:** Contrast the structural representation and SSP compliance of the traditional flat-onset model and the proposed adjunction model.

The syllabification of simple English words is straightforward and consistently supports the Onset-Rhyme model and the SSP. Monosyllabic words like *cap* [kæp], *but* [bʌt], and *right* [raɪt] exhibit the canonical sonority profile. Words with optional constituents are also easily accommodated. For example, *sea* [si:] has an onset /s/ and a nucleus /i:/ but an empty coda. *on* [ɒn] has an empty onset, a nucleus /ɒ/, and a coda /n/. In all these cases, the SSP is upheld.

The descriptive adequacy of the SSP faces its most significant challenge from English words beginning with three-consonant clusters, specifically those of the form /s/ + voiceless plosive + liquid (/spr-/ , /str-/ , /skl-/ , /skr-/) and /s/ + voiceless plosive + glide (/spj-/ , /stj-/ , /skj-/ , /skw-/). The most common examples are words like *spring* [sprɪŋ], *street* [stri:t], and *spleen* [spli:n].

According to the traditional, flat-structure approach to syllabification, all three consonants in these words are parsed together as a complex onset, as depicted in Figure 2 for *street*.

Figure 2: Traditional Syllabification of *street* (SSP-Violating)



This representation, however, creates a theoretical impasse. Applying Hu’s sonority scale, the problem becomes immediately apparent:

- /s/ is a voiceless obstruent (sonority level 1, the lowest).
- /t/ is a voiceless obstruent (sonority level 1).
- /r/ is a liquid (sonority level 4).
- /i:/ is a high vowel (sonority level 5).

The sonority sequence is: 1 -> 1 -> 4 -> 5. The transition from /s/ to /t/ represents a sonority plateau (1 → 1), where sonority remains flat. According to the criterion defined in Section 1.4, this constitutes a violation of the SSP. The same plateau violation occurs in all such clusters: *spring* (/s/ → /p/, both level 1), *spleen* (/s/ → /p/), and *squint* (/s/ → /k/). This systematic pattern poses a serious problem for the claim that the SSP is a universal principle, as it would force us to either abandon the principle or find an alternative structural analysis.

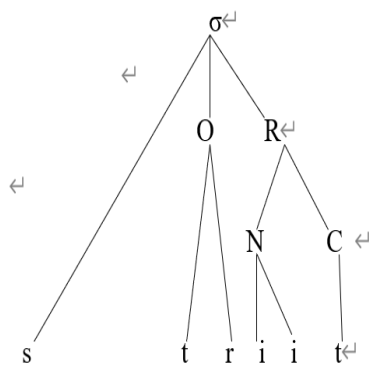
4. New method to deal with syllable structure

This section proposes a revised syllable structure model designed to resolve the SSP violations identified in the previous section. The core of this proposal is the recognition that the initial /s/ in clusters like /spr-/, /str-/, and /skl-/ holds a unique structural position. We argue that it should not be integrated into the onset but should instead be represented as an adjoined segment, attached directly to the syllable node.

The central idea is to structurally separate the problematic /s/ from the well-formed consonant cluster that follows it. In words like *street*, the consonants /t/ and /r/ form a legitimate branching onset, as their sonority profile (voiceless obstruent → liquid, i.e., 1 → 4) shows a clear, monotonic rise. This /tr-/ cluster is a perfectly well-formed onset in English (e.g., *trip*, *truck*). The same logic applies to /pr-/ in *spring* (cf. *pray*) and /pl-/ in *spleen* (cf. *play*). The initial /s/, therefore, is an “extra” consonant that cannot be accommodated within the onset without violating the SSP.

The proposed solution is to adjoin this extra /s/ directly to the syllable node (σ), creating a structure where the /s/ is a dependent of the syllable but is not part of its core onset constituent. This is illustrated in Figure 3 for *street*.

Figure 3: Proposed Syllable Structure with Adjoined /s/ for street

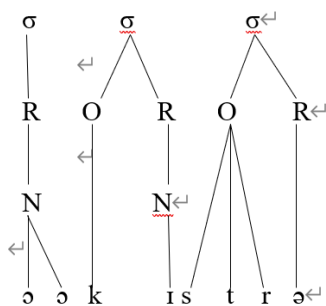


- The adjoined segment is /s/. It is attached directly to the highest node of the syllable, σ . It is licensed by the syllable but lies outside the core onset-rhyme structure.
- The onset (O) now contains only the well-formed cluster /tɹ/. This onset, considered in isolation, perfectly obeys the SSP, with sonority rising from /t/ (level 1) to /r/ (level 4).
- The rhyme (R) contains the nucleus /i:/ (level 5) and the coda /t/ (level 1), also in accordance with the SSP (fall from 5 to 1).

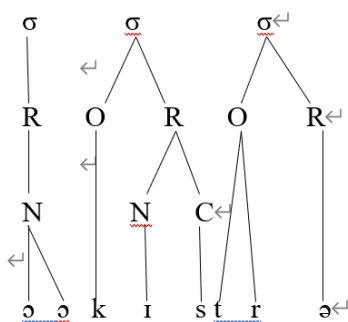
The theoretical motivation for the adjunction analysis is supported by syllabification evidence from word-medial contexts. Consider the syllabification of *orchestra*. If the /str/ cluster were a unitary onset, the Maximal Onset Principle would predict the syllabification [ɔ:kɪ.strə]. However, standard phonological treatments typically syllabify the word as [ɔ:kɪs.trə], where the /s/ is parsed as the coda of the second syllable, leaving /tr/ as the onset of the final syllable. This pattern is exactly what the adjunction analysis predicts: the /s/ is not part of the core onset and is therefore available to be syllabified as a coda.

Figure 4: Syllabification of orchestra supporting adjunction

(a) Incorrect syllabification if /str/ were a unit:



(b) Correct syllabification supporting adjunction:



In the correct syllabification (b), the /s/ is parsed as the coda of the second syllable ([kɪs]), and the well-formed onset /tr/ begins the final syllable. This pattern is systematic. In a word like *backstreet* ['bæk. stri:t], the compound boundary reinforces the same effect, with /s/ clearly belonging to the coda of the first syllable.

Table 1 presents a systematic comparative analysis of the two models for all relevant cluster types. This table is designed to enhance methodological transparency and replicability, allowing any researcher to verify the SSP compliance status of each word under each model by applying Hu's (2004) sonority scale and the plateau criterion defined in Section 1.4.

Table 1: Comparative Analysis of Traditional vs. Adjunction Model for SSP Compliance

| Word | Phonetic forms | Sonority Levels | Traditional Model (Flat Onset) | Adjunction Model (Proposed) |
|---------------|----------------|-----------------------|--|---|
| <i>spring</i> | [sprɪŋ] | 1 - 1 - 4 - 5 - 3 | Onset: /spr-/ Sonority Profile: 1→1→4→5 SSP Status: VIOLATION (Plateau: /s/-/p/) | Appendix: /s/ Onset: /pr-/ Sonority Profile: 1→4→5 SSP Status: COMPLIANT |
| <i>street</i> | [stri:t] | 1 - 1 - 4 - 5 - 1 | Onset: /str-/ Sonority Profile: 1→1→4→5 SSP Status: VIOLATION (Plateau: /s/-/t/) | Appendix: /s/ Onset: /tr-/ Sonority Profile: 1→4→5 SSP Status: COMPLIANT |
| <i>spleen</i> | [spli:n] | 1 - 1 - 4 - 5 - 3 | Onset: /spl-/ Sonority Profile: 1→1→4→5 SSP Status: VIOLATION (Plateau: /s/-/p/) | Appendix: /s/ Onset: /pl-/ Sonority Profile: 1→4→5 SSP Status: COMPLIANT |
| <i>squint</i> | [skwɪnt] | 1 - 1 - 4 - 5 - 3 - 1 | Onset: /skw-/ Sonority Profile: 1→1→4→5 SSP Status: VIOLATION (Plateau: /s/-/k/) | Appendix: /s/ Onset: /kw-/ Sonority Profile: 1→4→5 SSP Status: COMPLIANT |
| <i>spin</i> | [spɪn] | 1 - 1 - 5 - 3 | Onset: /sp-/ Sonority Profile: 1→1→5 SSP Status: VIOLATION (Plateau: /s/-/p/) | Appendix: /s/ Onset: /p-/ Sonority Profile: 1→5 SSP Status: COMPLIANT |

As Table 1 demonstrates, the traditional model yields SSP violations for all s-initial clusters due to the sonority plateau between /s/ and the following voiceless plosive. The adjunction model, by contrast, removes /s/ from the onset, creating an SSP-compliant structure in every case. The fundamental limitation of the traditional model is its assumption that all pre-nuclear consonants must be dominated by a single, flat onset node. This approach lacks the structural flexibility to recognize that the /s/ in these clusters might behave differently from the consonants that follow it.

5. Discussion

This section provides an extensive discussion of the theoretical implications of the adjunction analysis, addressing potential counterarguments and examining cross-linguistic evidence. The discussion is organized to move from theoretical consequences to empirical predictions and alternative analyses.

5.1 Theoretical Implications for the Universality of the SSP

The adjunction analysis reinforces the view that the SSP is a universal principle that operates on the core constituents of a syllable (onset, nucleus, coda), but not necessarily on peripheral extra-syllabic segments. By shifting the locus of explanation from the segmental string to the hierarchical structure, we can maintain the SSP's universality while accounting for language-specific patterns that appear to violate it. This is a significant theoretical gain: rather than treating the SSP as a violable constraint (which would weaken its explanatory power), we preserve it as an inviolable principle that applies to a designated structural domain. The special status of /s/ in English and other Germanic languages (e.g., German *Sprache*, Dutch *staan*) suggests that the ability to license an extra-syllabic appendix at the left edge of a syllable is a language-specific parameter. Languages like Spanish, which repair s-initial clusters via prothesis

(*spiritus > espíritu*), have this parameter set to a negative value. This parametric view captures cross-linguistic variation without abandoning the SSP.

5.2 Criteria for Extra-Syllabic Status

The concept of extra-syllabic segments has a long history in phonological theory. The adjunction analysis contributes to this debate by providing clear criteria for identifying extra-syllabic status, drawn from the English /s/ pattern: (1) Phonotactic privilege: Only /s/ (and marginally /ʃ/ in loanwords) appears in this pre-onset position, suggesting a special licensing status. (2) Sonority anomaly: The sonority plateau with the following voiceless plosive is precisely what motivates the extra-syllabic analysis. (3) Prosodic behavior: The tendency for word-medial /s/ to syllabify as a coda (e.g., *orchestra* [ˈɔ:kɪs. trə]) rather than as part of a complex onset shows that /s/ is not tightly bound to the following consonant. (4) Distributional restrictions: The pre-onset /s/ in English appears only before voiceless plosives, and only when those plosives are followed by a sonorant (liquid or glide) or, in simpler clusters, directly by a vowel.

These criteria can be applied to other languages to identify analogous extra-syllabic segments.

5.3 Addressing Potential Counterarguments

Before addressing the proposed analysis, several potential counterarguments should be considered. One possible objection is that the adjunction analysis merely shifts the problem elsewhere by introducing an unexplained appendix. However, this criticism is unfounded. The appendix is not an ad-hoc device but a well-motivated theoretical construct. Its existence is supported by at least three considerations: (1) phonotactic gaps – the set of segments that can appear in this position is highly restricted; (2) the lack of aspiration on the following stop, which suggests that the /s/ does not form a constituent with the stop; and (3) cross-linguistic parallels, such as the initial clusters /ks/ and /ps/ in Ancient Greek. Moreover, the appendix is independently required to account for word-final extra-syllabic consonants, as in the final /t/ of *next*.

Another concern is that the proposed analysis complicates syllable structure by adding a new structural position. In response, it should be noted that while the adjunction model does introduce an additional layer of complexity, this complexity is empirically justified. A theory that explains a wider range of data through a few principled extensions is preferable to a simpler theory that forces us to abandon a core universal principle. Thus, the adjunction analysis represents a conservative expansion of the existing model, not a radical overhaul.

5.4 Comparison with Alternative Analyses

Before turning to the proposed adjunction analysis, it is useful to consider three prominent alternative approaches that have been put forward to handle English s-initial clusters. Each of these alternatives, however, faces significant difficulties.

The first alternative treats the SSP as a violable constraint within Optimality Theory. In this approach, the SSP can be outranked by other constraints, such as faithfulness to the input form. Although this is theoretically possible, it weakens the claim that the SSP is a universal principle and consequently reduces its explanatory power. The adjunction analysis avoids this problem by demonstrating that the SSP is not actually violated at the level of core syllable structure; the apparent violation arises only when the initial /s/ is misanalyzed as part of the onset.

A second alternative proposes that the initial /s/ constitutes a separate syllable, often referred to as a “minor syllable” or “moraic appendix.” This analysis, however, creates a new problem: by definition, a syllable must contain a nucleus, but /s/ alone cannot function as a nucleus in English. The adjunction analysis circumvents this difficulty by attaching the /s/ directly to the syllable node without positing an additional syllable.

A third alternative treats sequences such as /sp/ as complex segments, similar to affricates or contour segments. This analysis fails to explain why the voiceless stop in such sequences can be followed by a liquid or glide, as in *spl-* or *str-*. Complex segments typically do not allow further expansion, yet /spl-/ and /str-/ clearly do. The adjunction analysis captures both the cohesion between /s/ and the following stop and the possibility of further expansion by analyzing the remaining /pr-/ , /tr-/ , or /kl-/ as a well-formed onset.

Thus, while each of these alternative analyses raises important issues, none provides a satisfactory solution to the SSP violation posed by English s-initial clusters. The adjunction analysis, by contrast, offers a principled and empirically coherent account.

5.5 Cross-Linguistic Extensions

The adjunction analysis gains additional support from cross-linguistic evidence. Other Germanic languages show comparable patterns (e.g., German *Sprache*, Dutch *staan*). Slavic languages present even more complex initial clusters (e.g., Polish *wstęp* [fstɛmp]), suggesting multiple appendix positions. The adjunction framework can be extended to account for these patterns by allowing multiple adjunction sites or a more elaborate appendix structure. Semitic languages, where morphological processes create complex word edges, may also be analyzable in these terms.

5.6 Psycholinguistic and Acquisitional Implications

Although this study is theoretical, the adjunction model makes testable predictions for future experimental research. For instance, English-learning children often simplify s-initial clusters by deleting the /s/ (e.g., [pɪŋ] for *spring*), which is consistent with the appendix analysis: children may initially fail to license the appendix /s/, producing only the core syllable. Speech error patterns also support the model: errors such as “pring” for *spring* (deleting the /s/) are more common than errors like “sping” (deleting the /r/), suggesting that /pr/ behaves as a unit. These predictions await systematic experimental verification.

6. Conclusion

This study has undertaken a detailed investigation of the Sonority Sequencing Principle and its application to English s-initial consonant clusters. The persistent challenge posed by clusters like /spr-/ , /str-/ , and /skl-/ served as the primary motivation. Through a comprehensive literature review and a comparative structural analysis following a transparent three-step procedure (SSP violation assessment, sonority level evaluation, and model comparison), we identified the core conflict: the traditional parsing of these clusters as a single onset forces a sonority plateau between /s/ and the following voiceless plosive, directly violating the SSP.




In response, this paper proposed and defended a revised model in which the initial /s/ is analyzed as an adjoined extra-syllabic segment, attached directly to the syllable node. This reanalysis has several consequences:

1. It restores the explanatory power of the SSP for English, as the core onset now exhibits a perfect sonority rise (e.g., /pr/, /tr/, /pl/, /kw/).
2. It provides a principled account for the unique phonological behavior of /s/, including its failure to aspirate a following stop and its tendency to syllabify as a coda in word-medial positions (e.g., *orchestra*, *backstreet*).
3. It offers a theoretically coherent solution compatible with major phonological frameworks, while preserving the SSP as an inviolable universal principle.
4. It has implications for cross-linguistic typology (parametric variation in appendix licensing), language acquisition (predicted simplification patterns), and historical linguistics (the diachronic stability of /s/ as an appendix).

The reanalysis underscores the importance of hierarchical structure in phonology. The SSP remains a universal principle, but its application is to the core constituents of the syllable, not necessarily to every

segment in a linear string. By recognizing that the syllable has a core-periphery structure, we can maintain the SSP as a universal principle while accounting for complex, language-specific patterns. This study thus reinforces the syllable's centrality in phonological analysis and opens up new avenues for empirical research into the nature of phonological constituents and the boundaries of universal grammar.

Англи хэлний S-ээр эхэлсэн гийгүүлэгчийн бүлгийг Авиалаг чанарын дарааллын зарчим ашиглан дахин шинжилсэн нь

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Хураангуй. Энэхүү өгүүлэл нь Авиалаг чанарын дарааллын зарчим (Sonority Sequencing Principle, SSP)-ын илэрхий зөрчил нь англи хэлний үеийн бүтцэд дахин шинжилгээ хийх шаардлагатайг нотлон харуулж байна. Өргөн хүрээний авиа зүйн судалгааны бүтээлүүд болон үежүүлэлтийн нотолгоонд тулгуурлан, бид эдгээр авианы дараалал дахь эхний /s/ авиаг үеийн үндсэн эхлэл (onset)-ийн бүрэлдэхүүн хэсэг гэж үзэх нь тохиромжгүй гэж үзэж байна. Харин үүнийг үеийн зангилаанд (syllable node) шууд холбогдсон, нэмэлт үет бус (extrasyllabic) нэгж хэмээн тайлбарлах нь оновчтой юм. Энэхүү шинэчилсэн загвар нь жинхэнэ onset-ийг зөв бүтэцтэй /pr/, /tr/, /kl/ зэрэг авианы бөөгнөрөл гэж үзэх замаар Авиалаг чанарын дарааллын зарчмын түгээмэл чанар болон тайлбарлах чадварыг бүрэн хадгалж байна. Бид энэхүү дахин шинжилгээний эмпирик үндэслэлийг англи хэлний үгийн дундах үежүүлэлт, нийлмэл үг бүтэх үйл явц, мөн дахин үежүүлэгдэх хэв шинжүүдийг шинжлэх замаар харуулж байна. Удаан хугацаанд маргаан дагуулсан /s/-ийн парадоксыг шийдвэрлэснээр энэхүү судалгаа нь англи хэлний үеийн бүтцийн илүү уялдаа холбоотой, эмпирик үндэслэл сайтай загварыг санал болгож, SSP-ийг авиа зүйн онолын суурь зарчим болохыг дахин бататгаж байна.

Түлхүүр үг: Үеийн бүтэц, Авиалаг чанарын дарааллын зарчим, Гийгүүлэгчийн бүлэг, Нэмэлт үет бүтэц, Англи хэлний авиа судлал, /s/-ээр эхэлсэн гийгүүлэгчийн бүлэг, Авианы зохицлын тогтолцоо

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