1 Introduction

A body of work has established that the broad details of word stress in Polish meet with straightforward analysis in a variety of theoretical frameworks (Comrie 1976; Franks 1985; Hayes and Puppel 1985; Rubach and Booij 1985; Halle and Vergnaud 1987; Hammond 1989; Idsardi 1992; Kraska-Szlenk 2003). Recently, however, Kraska-Szlenk (2003) has pointed out that the finer details of word stress in Polish – concerning compounds, lexical exceptions, and clitic groups – are not so straightforward. Kraska-Szlenk (2003) demonstrates that these finer details can be accounted for within a monostratal Optimality Theoretic framework.

In this paper, I present novel data that introduce further complications related to the treatments of faithfulness and exceptionality. I show that the extension of Kraska-Szlenk’s (2003) monostratal OT analysis to account for these data requires extensive reference to phonological domains that approximate levels of morphological composition, subjecting them to the same alignment constraints and promoting faithfulness between them. I also show that the monostratal OT account is fundamentally limited in its ability to fully account for the data due to its lack of two meaningful distinctions: derived versus inflected words; and first versus second components of a compound. I present an alternative analysis within a multistratal OT framework, which leverages the similarity of phonological processes across levels of morphological composition by imposing similar OT phonologies at each such level. Because the multistratal framework encodes in its stratal organization the differences of derivation versus inflection and first versus second component of a compound, it is capable of accounting for dependencies on these differences in the data.

*My thanks to Aleksander Główka for creating novel compounds and giving judgments, to Katarzyna Główka for giving judgments, and to other members of the Główka family for their assistance with various aspects of the data presented here. Thanks also to Paul Kiparsky for practical and theoretical guidance.
My discussion is concerned with primary and non-primary stress placement in words and word-clitic combinations. I do not consider aspects of segmental phonology or the details of syllabification or clitic structure. I also do not consider the relative prominence of stresses beyond the primary–non-primary division, and I do not consider phrasal stress beyond the combination of words with clitics. Kraska-Szlenk (2003) gives accounts of these phenomena within a monostatal OT approach to metrical grid theory, which is likely able to be made compatible with the multistratal OT account of stress placement given here.

1.1 Notational preliminaries

The data that I present are in standard Polish orthography, which can be straightforwardly mapped to phonemic representations as shown in Appendix A. It is important to note that a sequence of two vowel graphemes corresponds to a disyllable, unless the first one is i, in which case it corresponds to a monosyllable with a palatalized onset, or the second one is u, in which case it corresponds to a monosyllable with a rounding offglide to the nucleus.

I notate a stress by a numerical superscript on top of the vowel nucleus of the stressed syllable; 1 indicates primary stress, and 2 indicates non-primary stress. I also make use of symbols indicating morphological boundaries of different types: derivational (·); inflectional (-); compound (+); and clitic (=).

Many of the novel data that I present are constructed compounds; they do not exist in the native speaker’s lexicon. Nevertheless, they are readily recognizable as plausible compounds because compounding in Polish is productive and morphologically transparent by use of the linking morpheme -o- (Szymanek 2009). For clarity, I mark constructed data with the symbol ⊗.

Finally, I supplement concrete examples from the language with abstract templates of syllables and feet for the purpose of illustrating the analyses. Syllables are represented by the symbol σ, foot boundaries are indicated by parentheses (σσ), and the head foot (which has crucial theoretical status in the multistratal account) is underlined (σσ).

The symbols used for data annotation are summarized in Table 1.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>primary stress</td>
</tr>
<tr>
<td>2</td>
<td>non-primary stress</td>
</tr>
<tr>
<td>·</td>
<td>derivational boundary</td>
</tr>
<tr>
<td>-</td>
<td>inflectional boundary</td>
</tr>
<tr>
<td>+</td>
<td>compound boundary</td>
</tr>
<tr>
<td>=</td>
<td>clitic boundary</td>
</tr>
<tr>
<td>⊗</td>
<td>constructed compound</td>
</tr>
<tr>
<td>σ</td>
<td>syllable</td>
</tr>
<tr>
<td>(σσ)</td>
<td>foot</td>
</tr>
<tr>
<td>(σσ)</td>
<td>head foot</td>
</tr>
</tbody>
</table>
2 Existing data

I begin by presenting data from the literature on Polish word stress, to establish the known patterns to be accounted for. For each datum, I cite the earliest source in which I found it reported.

Word stress in Polish is not sensitive to any properties of the syllable (e.g. weight); instead, it falls on syllables according to their position in the word. The number of syllables in a word is transparent from the orthography because only a vowel can form a syllable nucleus (Rubach and Booij 1990), and all vowels are represented orthographically by single characters (except i before a vowel and u after a vowel, which are non-vocalic as noted in Section 1.1).

2.1 Basic word stress template

The basic template for word stress in Polish is straightforwardly described as follows: primary stress on the penult, secondary stress on the initial syllable, and rhythmic stress¹ on every intervening odd syllable (except the antepenult, in the case of an even-syllabled word). In metrical terms, this can be described as a template of binary feet with a trochee at the right edge, yielding primary stress, a trochee at the left edge, yielding secondary stress, and left-aligned trochees inbetween, yielding rhythmic stress (Hayes 1995). The right-aligned (head) trochee is compulsory and may be constituted by a degenerate unary foot in the case of a monosyllabic word; any other foot cannot be formed when there are insufficient syllables to make it binary. This basic template is illustrated in (1)².

(1) Basic word stress template

a. \text{kot} \quad (σ) \quad \text{cat.NOM.SG} \quad \text{(Comrie 1976)}

b. \text{reporter} \quad σ(σσ) \quad \text{reporter.NOM.SG} \quad \text{(Rubach and Booij 1985)}

c. \text{reporter-owi} \quad (σσ)σ(σσ) \quad \text{reporter-DAT.SG} \quad \text{(Rubach and Booij 1985)}

d. \text{rewolucjon-ist-ami} \quad (σσ)(σσ)(σσ) \quad \text{revolution-ary-INST.PL} \quad \text{(Rubach and Booij 1985)}

¹Rubach and Booij (1985) attribute the first detailed discussion of rhythmic stress in Polish to Dłuska (1957). They note that rhythmic stress appears only in slow, citation-style speech; in faster, more casual speech, only the primary stress is evident, though the initial secondary stress is noticeable in intermediate speech styles. While the acoustic basis of rhythmic stress in Polish is not well understood (Newlin-Łukowicz 2012), recent evidence suggests that it manifests as oscillations in the ratio of consonant:vowel duration (Łukaszewicz 2015).

²While I maintain a distinction between initial secondary stress and alternating rhythmic stress for empirical reasons, following Kraska-Szlenk (2003), I do not distinguish between them in terms of formal identification of prominence; both are notated as non-primary stresses and formally represented within non-head feet.
2.2 Irregular primary stress

Though the vast majority of Polish words have penultimate primary stress, it is well-known that there exist exceptions with primary stress on the antepenult or final syllable. Idsardi (1992) divides the exceptions into three classes: P/A stems, A/P stems, and F/P stems. P/A stems have penultimate stress when appearing alone (i.e. with null inflection) and antepenultimate stress when appearing with a monosyllabic inflectional suffix, as in (2). A/P stems have antepenultimate stress when appearing alone and penultimate stress when appearing with a monosyllabic inflectional suffix, as in (3). F/P words have final stress when appearing alone and penultimate stress when appearing with a monosyllabic inflectional suffix, as in (4). All exceptional words have penultimate stress when appearing with a disyllabic inflectional suffix (5) or a derivational suffix (6).

(2) Exceptional P/A stems

a. gramatyk
   grammar.GEN.PL
   \(\sigma(\sigma\sigma)\)  
   (Rubach and Booij 1985)

b. gramatyk-a
   grammar-NOM.SG
   \(\sigma(\sigma\sigma)-\sigma\)  
   (Rubach and Booij 1985)

(3) Exceptional A/P stems

a. uniwersytet
   university.NOM.SG
   \((\sigma\sigma)(\sigma\sigma)\sigma\)  
   (Comrie 1976)

b. uniwersytet-u
   university-GEN.SG
   \((\sigma\sigma)(\sigma\sigma)(\sigma-\sigma)\)  
   (Comrie 1976)

(4) Exceptional F/P stems

a. reżim
   regime.NOM.SG
   \(\sigma(\sigma)\)  
   (Comrie 1976)

b. reżim-u
   regime.GEN.SG
   \(\sigma(\sigma-\sigma)\)  
   (Idsardi 1992)

(5) Exceptionality erasure under disyllabic inflection

a. gramatyk-ami
   grammar-INST.PL
   \((\sigma\sigma)\sigma-(\sigma\sigma)\)  
   (Rubach and Booij 1985)
2.3 Compound stress

Compounding in Polish is productive and morphologically transparent, by use of the compound linking morpheme -o- (allomorphs: -i-, -y-, -u-, and -o-) (Szymanek 2009).

The components of a compound independently follow the basic stress template established in Section 2.1 (including the linking morpheme in the first component), with the rightmost stress of the compound being primary (7a). By consequence, a compound with two odd-syllabled components has two “gaps” of a single syllable each in the regular alternating stress pattern (7a, c.f. 7b). Exceptions to this pattern are found for compounds with monosyllabic components, which Rubach and Booij (1985) suggest are stressed like normal words (7c–7f).

In compounds with a trisyllabic first component (and a polysyllabic second component), Rubach and Booij (1985) observe variation in the placement of stress: the first component may be stressed either on its penult or on its initial syllable (7g). Kraska-Szlenk (2003) does not address this variation, presenting only the variants with penult stress in the first component.

(7) Compound stress

a. 2 2 demokra-tyczn-o + 2 1 republikań-sk-i
democratic-CPD + republican-ADJ-NOUN.NOM.SG

b. * 2 demokra-tyczn-2 + 2 1 republikań-sk-i
*democratic-CPD + republican-ADJ-NOUN.NOM.SG

(7a) (σσ)(σσ)σ(σσ)
(Kraska-Szlenk 2003)

(7c) σ(σ+σ)
(Rubach and Booij 1985)

(7d) (σσ)(σ+σ)
(Rubach and Booij 1985)

(7e) (σ+σ)
(Kraska-Szlenk 2003)
2.4 Clitics and stress

Clitics in Polish include a host of monosyllabic function words: pronouns, prepositions, conjunctions, particles, adverbials, and the conditional marker (Rubach and Booij 1985; Kraska-Szlenk 2003). I will not be concerned with the constraints on clitic attachment here, and will only discuss the placement of stresses within clitic-host combinations.

A single proclitic receives secondary stress when possible (8a), but does not interfere with the primary stress of a monosyllabic (8b) or disyllabic (8c) host. Attachment of a single proclitic to a 5-syllable host creates a site for an additional secondary stress in the middle of the host (8d). When a single proclitic is attached to a host of more than 5 syllables, the rhythmic stresses in the host are not affected (8e). A sequence of proclitics is stressed on odd syllables but does not interfere with the stresses of the host (8f).

(8) Proclitics

a. \( \text{do} = \text{profesor-a} \)
   \( \text{to} = \text{professor-GEN.SG} \)
   \( (\sigma=\sigma)\sigma(\sigma\sigma) \)
   (Kraska-Szlenk 2003)

b. \( \text{na} = \text{dom} \)
   \( \text{on} = \text{house.ACC.SG} \)
   \( \sigma=\sigma \)
   (Rubach and Booij 1985)

c. \( \text{do} = \text{dom-u} \)
   \( \text{to} = \text{house-GEN.SG} \)
   \( \sigma=\sigma\sigma \)
   (Rubach and Booij 1985)

d. \( \text{do} = \text{Kanadyjczyk-a} \)
   \( \text{to} = \text{Canadian-GEN.SG} \)
   \( (\sigma=\sigma)(\sigma\sigma)(\sigma\sigma) \)
   (Kraska-Szlenk 2003)

e. \( \text{do} = \text{Amerykanin-a} \)
   \( \text{to} = \text{American-GEN.SG} \)
   \( (\sigma=\sigma)(\sigma\sigma)(\sigma\sigma) \)
   (Kraska-Szlenk 2003)

f. \( \text{by} \) = ście = \( \mu \) = go = tam = mie-li
   \( \text{COND} = \text{2.PL.NOM} = \text{3.SG.M.DAT} = \text{it} = \text{there} = \text{have-PAST} \)
   \( (\sigma=\sigma)(\sigma\sigma)=\sigma=\sigma(\sigma\sigma) \)
   (Kraska-Szlenk 2003)

---

3The disyllabic pronoun \( \text{koło} \) ‘near’ is reportedly also a clitic (Rubach and Booij 1985).

4(8f) is an extract from the sentence \( \text{Dlaczego byście mu go tam mieli zawieźć?} \) ‘Why should you Pl deliver it/him for him there?’. Kraska-Szlenk (2003) states that this sentence is very odd, but that the stress intuitions are robust if a speaker accepts it as reasonable.
In a sequence of enclitics, the penultimate enclitic gets a non-primary stress (9a). A single enclitic does not affect the primary stress of the host (9b), but when an enclitic attaches to a host with antepenultimate stress, the final syllable of the host will receive non-primary stress (9c). In a long sequence of enclitics, the first enclitic receives stress in addition to the penult (9d).

\[ \begin{align*}
(9) \text{ Enclitics} \\
\text{a.} & \quad zrob\-li = mu \quad \text{by} \quad \text{śćie} \\
& \quad \text{do-PAST} = 3.\text{SG.M.DAT} = \text{COND} = 2.\text{PL.NOM} \\
& \quad \text{'you.PL would do for him'} \\
\text{b.} & \quad \text{wagon} = nasz \\
& \quad \text{wagon} = \text{our} \\
\text{c.} & \quad \text{fizyk-ę} = mu \\
& \quad \text{physics-ACC} = 3.\text{SG.M.DAT} \\
\text{d.} & \quad \text{kupi-ł} = \text{by} \quad \text{go = on = tam} \\
& \quad \text{buy-PAST = COND = 3.\text{SG.M.DAT} = it = he = there} \\
& \quad \text{'he would buy it for him there'}
\end{align*} \]

Kraska-Szlenk (2003) observes that the clitics się (REFL),这件 (2.PL.NOM), and śmy (1.PL.NOM) are weak and repel stress when possible (for details, see Kraska-Szlenk 2003, pp. 44–46). This is secondary to the core phenomena under investigation here and I will not discuss it further; it can be accounted for straightforwardly by the addition of an appropriate constraint. The data I present avoid situations in which weak syllables affect observed stress patterns.

## 2.5 General observations

The data presented in this section give rise to an observation: very similar templates for stress appear to be followed for words, constituents of compounds, and clitic-host combinations. Each of these units has (when possible) a foot at the right edge and other feet aligned to the left edge. The novel data I present in Section 4 highlight additional similarities that have been previously overlooked.

However, there are also important differences between the stress patterns of these different units. For example, a non-compound word may have at most one unfooted syllable (1e), whereas a compound (7a) or clitic-host sequence (9a) may have two (or more, in the case of combined procliticization and encliticization); a monosyllabic component in a compound affects primary stress (7c–7e), but a monosyllabic proclitic (8b) or enclitic (9b) does not; and the final foot always carries primary stress in words (1), but never in enclitic sequences (9a). Furthermore, there is an important distinction to be made between inflection, under which exceptions to penult stress can be seen (2–4), and derivation, under which they cannot (6).

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5 Kraska-Szlenk (2003) states that this judgment is marginal because such cases are very difficult to construct; the clitic placement required for (9c) is only licensed if the following verb is focused, as in Janek fizykę=mu TLUMACZYŁ, ale on i tak nic nie zrozumiał ‘John EXPLAINED physics to him, but he still understood nothing’.

6 Kraska-Szlenk (2003) states that (9d) is “somewhat awkward”, but that the stress intuitions are robust if a speaker accepts it as reasonable.
It is clear from this that any analysis must make reference to these different kinds of units in some way. The challenge for a successful analysis is to leverage the similarities between them efficiently while still allowing for their differences.

3 A monostratal OT analysis

Kraska-Szlenk (2003) presents a monostratal OT analysis accounting for the pattern of data described in Section 2. Here, I briefly outline this analysis, to facilitate comparison with the multi-stratal OT analysis I will present in Section 5. For discussion of the analysis, including ranking arguments and tableaux, see Kraska-Szlenk (2003).

3.1 Phonological domains

The only option available to the monostratal analysis for referring to the different types of “units” discussed in Section 2.5 is through the use of domains. Kraska-Szlenk encodes the morphologically nested units in similarly nested prosodic domains and assumes that these domains are assigned within the monostratal OT phonology, so that their boundaries are visible to phonological constraints (see her Section 3.6). Since the mapping of morphological units to prosodic domains is unaffected by phonological content, it is equivalent to state that the prosodic domains are pre-assigned to the input to the phonology according to fixed templates.

The prosodic domains used in the analysis are as follows (in order of increasing size; brackets indicate boundary notation):

\[
\textit{PWord} \langle \cdots \rangle
\]

Includes a stem plus its inflectional suffixes; prefixes introduce recursive PWords. Each of the components of a compound constitutes its own PWord; the first (recursively) includes any prefixes and the compound linking morpheme, and the second includes any suffixes. The compound as a whole is not a PWord. Clitics generally do not constitute PWords. This notion of PWord is not equivalent to the notion of Prosodic Word contained within the Prosodic Hierarchy.

\[
\textit{MWord} \{\cdots\}
\]

Includes all maximal (morphological) combinations of PWords, i.e. all maximal contiguous sequences of stems and affixes. Words (non-compounds and compounds, but not compound components) constitute MWords, but clitics or cliticized forms do not. The MWord is both a morphosyntactic and a phonological unit; the phonological unit may be considered to correspond to the maximal PWord, or the standard notion of Prosodic Word from the Prosodic Hierarchy.

\[
\textit{PUnit} \[
\]
\]

Includes an MWord and all of its attached clitics (if any; uncliticized simple words and compounds are also PUnits). The PUnit is equivalent to the Clitic Group from the Prosodic Hierarchy.

Example templates for the assignment of domains are given in (10):

(10) Prosodic domain templates

a. \[\langle\langle\text{prefix-}\langle\text{root-suffix-suffix}\rangle\rangle\rangle\]
b. \[\langle\langle\text{prefix-}\langle\text{root-o}\rangle\rangle\rangle+\langle\text{root-suffix-suffix}\rangle]\]
c. \[\text{clitic}=\langle\langle\text{prefix-}\langle\text{root-o}\rangle\rangle+\langle\text{root-suffix-suffix}\rangle\rangle\]
3.2 Constraints

The key constraints utilized by Kraska-Szlenk are as follows, given in order of dominance:

- **Edge-R(MWd)** Assign a violation if the rightmost foot in the MWord is not the head foot\(^7\).
- **Trochee** Assign a violation for each foot whose head syllable is not aligned to the left.
- **MWd⊃Ft** Assign a violation if an MWord does not properly contain at least one foot.
- **Unstr-ik** Assign a violation for each weak syllable that is stressed\(^8\).
- **FtBin** Assign a violation for each foot that does consist of exactly two syllables.
- **Align-MWd-R** Assign a violation for each syllable intervening between the right edge of the rightmost foot in the MWord and the right edge of the MWord.
- **Align-PWd-R** For each PWord, assign a violation for each syllable intervening between the right edge of the rightmost foot in the PWord and the right edge of the MWord.
- **Align-PU-L** Assign a violation for each syllable intervening between the left edge of the leftmost foot in the PUnit and the left edge of the PUnit.
- ***Lapse** Assign a violation for each sequence of two unfooted syllables.
- **Ident-MWd** Assign a violation for each foot in a clitic-host combination that does not correspond to (i.e. contain all and only the corresponding syllables in) a foot in the host as it would exist without clitics, and vice-versa\(^9\).
- **Parse-Syll** Assign a violation for each unfooted syllable.
- **Align-PU-R** Assign a violation for each syllable intervening between the right edge of the rightmost foot in the PUnit and the right edge of the PUnit.
- **Align-Ft-L** For each foot, assign a violation for each syllable intervening between its left edge and the left edge of the PUnit.

---

\(^7\)Kraska-Szlenk uses a grid-theoretic approach to prominence which contains more than just this constraint, as it makes a distinction between secondary and rhythmic stress and aims to analyze prominence as gradient more generally. For present purposes, i.e. to distinguish primary and non-primary stress, only this constraint is required, and it may be ranked freely with respect to the other constraints as stress location and prominence do not interact.

\(^8\)Kraska-Szlenk, following Comrie (1976), assumes that lexical exception words are exceptional because their penultimate vowel (typically \(\text{y}\)) is prosodically weak and repels stress. While this might seem to take advantage of a mechanism which is independently needed for weak clitics, as briefly outlined at the end of Section 2.4, the two cases cannot be analyzed by means of the same constraint as weak clitics are stressed in even-syllable sequences whereas even-syllabled lexical exceptions have exceptional stress.

\(^9\)In Kraska-Szlenk's analysis, this constraint enforces identity to a base, which is established to be the unmarked phonological form of the morphosyntactic word by a constraint **Unmark**. I have omitted **Unmark** and built the intention of **Ident-MWd** into its definition.
3.3 Observations

It should be immediately apparent that the monostratal analysis does not predict the variation in stress placement observed in compounds with a trisyllabic first component (7g), as it has a fixed constraint ranking. This is illustrated in the tableau in (11) (only the relevant constraints and candidates are shown).

\[(\{(\sigma\sigma\sigma) + (\sigma\sigma)\}) \quad \text{ALIGN-PWd-R} \quad \text{ALIGN-PU-L}\]

<table>
<thead>
<tr>
<th></th>
<th>Align-PWd-R</th>
<th>Align-PU-L</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>(σσ) + (σσ)</td>
<td>*</td>
</tr>
<tr>
<td>b</td>
<td>(σσσ)σ + (σσ)</td>
<td>*!</td>
</tr>
</tbody>
</table>

The variation can be obtained straightforwardly by having ALIGN-PWd-R and ALIGN-PU-L freely ranked with respect to one another. This predicts variation when the PWd in question does not contain enough syllables to form two binary feet left of the MWd-final foot and is initial in the PUnit. Thus, variation is predicted in cases of compounds with a trisyllabic first component and a polysyllabic second component, and in cases of compounds with a 4-syllable first component and a monosyllabic second component. The latter case is unattested in the literature; if it does not occur, then either ALIGN-PWd-R must be reformulated in a non-gradient manner, or a higher-ranked constraint must be introduced that penalizes non-initial stress in 4-syllable components but not in trisyllabic components.

It should also be apparent that the monostratal analysis cannot explain why lexical exceptions regularize under monosyllabic derivation, as it makes no distinction between inflectional suffixes and derivational suffixes (incorporating both within a flat PWord structure). A possible solution is to introduce a new domain that is sensitive to derivational boundaries and a constraint requiring a foot to be aligned to the right edge of this domain, which dominates Unstr-ik. However, assuming that the hierarchy of domains is exhaustive (so that each item passing through the phonology has all of the prosodic domains represented), this leaves the question of how this domain is represented in non-derived exceptional words, which show different behavior.

Note that the monostratal analysis includes a right-alignment constraint for each of the domains PWord, MWord and PUnit, and an output-output identity constraint promoting faithfulness between MWords and PUnits. Since ALIGN-MWD-R dominates ALIGN-PWD-R and Ident-MWD dominates ALIGN-PU-R, a general remark can be made that the assignment of foot structure to larger prosodic domains is prioritized over the assignment of foot structure to smaller prosodic domains, except where blocked by faithfulness to the foot structure of smaller prosodic domains. This generalization is also supported by the left-alignment constraints; the lack of appeal to left-alignment constraints on the PWord and MWord can be taken to imply that left-alignment in the PUnit is prioritized over left-alignment in smaller prosodic domains, except where blocked by faithfulness to rhythmic structure in the MWord (by the dominance of Ident-MWD over Align-Ft-L). This has the beginnings of a stratal appeal, and I will present novel data in Section 4 that strengthen this appeal further.

4 Novel data and implications

The data presented in the literature has established faithfulness relations between a word standing alone and the same word with clitics attached. Here, I present novel data suggesting that the same kind of relations exist between a word standing alone and the same word when constituting
a component of a compound, and between a word with null inflection and the same word with disyllabic inflection.

The literature has also established that certain words have exceptional stress patterns under inflection, but not derivation. I present novel data concerning these words in compounds, which shows that exceptional stress patterns are preserved in the first component of a compound, but not in the second component.

Finally, the literature has established variation in non-primary stress placement in compounds with a trisyllabic first component and a polysyllabic second component. I show that the same variation is seen in compounds with a lexical exception stem as a first component and a monosyllabic second component. I also show that variation exists in non-primary stress placement in long words under disyllabic inflection.

Many of the novel data presented here are unattested compounds which were constructed by a native speaker of Polish (AG). These constructed data yield valid insights into the Polish stress system due to the morphological transparency of compounding in Polish.

For each item, I solicited judgments from two native speakers of Polish (AG and KG). AG is a linguist and generated acceptable and unacceptable stress patterns for each item. For KG’s judgments, I asked her to produce the word at a comfortable reading pace and auditorily judged the locations of the stresses. I then produced versions of each item varying in stress placement and asked for explicit judgments on these variants.

While the data may not be able to be treated as robust due to the small number of informants used for this study, its true value is its novelty. It explores stress judgments for structures that the literature does not explore but nevertheless makes predictions for. The discussion of implications and analysis is intended as a pointer to how these intriguing judgments, if robust, could be explained by phonological theory. I welcome further tests of the robustness of these judgments by other native speakers.

4.1 Faithfulness under compounding

Rubach and Booij (1985) suggested that a compound with a monosyllabic first component is stressed following the basic word template discussed in Section 2.1. However, that is not the case; as shown in (12), when the second component of such a compound is long enough to yield a medial (rhythmic) non-primary stress, that stress is not aligned to the left of the compound but is rather exactly where it would fall in the second component standing alone. In this way, a compound with a monosyllabic first component behaves like a word with a single proclitic.

(12) Faithfulness to rhythmic stress in compounds

\[
\begin{align*}
\text{a. } & \text{rewolucjon-ist-a} \\
& \text{revolution-ary-NOM.SG} & & \sigma\sigma(\sigma\sigma) \sigma\sigma \\
& & \text{(Rubach and Booij 1985)}
\end{align*}
\]

\[
\begin{align*}
\text{b. } & \text{dw-u} + \text{rewolucjon-ist-a} \\
& \text{two-CPD + revolution-ary-NOM.SG} & & (\sigma + \sigma)(\sigma\sigma) \sigma\sigma \\
& & \text{‘double-revolutionary’} & \text{(AGpc, KGpc)}
\end{align*}
\]

\[
\begin{align*}
\text{c. } & \text{dw-u} + \text{rewolucjon-ist-a} \\
& \text{two-CPD + revolution-ary-NOM.SG} & & * (\sigma + \sigma)(\sigma\sigma) \sigma\sigma \\
& & \text{(AGpc, KGpc)}
\end{align*}
\]
This observation is problematic for the monostratal analysis as it currently stands because the foot in question is not aligned to the left of any given domain. The analysis incorrectly predicts that the foot should be left of where it is, due to the constraint ALIGN-Ft-L. The analysis cannot be corrected by assuming a right-alignment constraint, because such a constraint would make incorrect predictions in any other circumstance and could not be restricted to be active only in the present circumstance.

To account for this observation within the monostratal analysis, a constraint must be assumed promoting faithfulness between PWords and MWords. To be framed as an Output-Output faithfulness constraint, it must take the form of faithfulness between the phonological forms (outputs) of two related morphosyntactic entities (inputs). The PWord is not a morphosyntactic entity, but can be approximated by the morphological unit of Stem. The required constraint then promotes faithfulness to the phonological realization of the morphosyntactically-unmarked (nominative singular) form of the Stem:

**Ident-PWd**  
Assign a violation for each foot in a Stem (PWord) that does not correspond to (i.e. contain all and only the corresponding syllables in) a foot in the nominative singular form of the Stem, and vice-versa.

To yield the structure seen in (12), **Ident-PWd** must be ranked above **ALIGN-Ft-L**, but below **FtBin** and **ALIGN-PU-L**, as illustrated in the tableau in (13).

<table>
<thead>
<tr>
<th>(σ)+⟨σσσσσ⟩</th>
<th>FtBin</th>
<th>ALIGN-PU-L</th>
<th>Ident-PWd</th>
<th>ALIGN-Ft-L</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. (σ+σ)σ(σσ)(σσ)</td>
<td></td>
<td></td>
<td>***</td>
<td>8</td>
</tr>
<tr>
<td>2. (σ+σ)(σσ)σ(σσ)</td>
<td></td>
<td></td>
<td>****!</td>
<td>7</td>
</tr>
<tr>
<td>3. σ+(σσ)(σσ)(σσ)</td>
<td>*</td>
<td></td>
<td>*</td>
<td>9</td>
</tr>
<tr>
<td>4. (σ)+(σσ)(σσ)(σσ)</td>
<td>*!</td>
<td></td>
<td></td>
<td>9</td>
</tr>
</tbody>
</table>

Note that this also implies that **Ident-PWd** is ranked below **ALIGN-PWd-R**. This ranking predicts that, if the first component of a compound has a null nominative singular inflection, it will still be stressed on its penult rather than on its antepenult (which corresponds to the penult in the nominative singular base). As shown in (14), this prediction is correct.

<table>
<thead>
<tr>
<th>Lack of faithfulness to non-rhythmic stress in compounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. 2 rozwozieli deliverer.NOM.SG (σσ)(σσ) (AGpc, KGpc)</td>
</tr>
<tr>
<td>b. © rozwozieli-o + kropek deliverer-CPD + dots (σσ)σ(σσ)+(σσ) (AGpc, KGpc)</td>
</tr>
<tr>
<td>c. * rozwozieli-o + kropek deliverer-CPD + dots *(σσ)(σσ)σ+(σσ) (AGpc, KGpc)</td>
</tr>
</tbody>
</table>
4.2 Faithfulness under disyllabic inflection

The basic stress template predicts that, when disyllabic inflection is added to a stem, all other feet are aligned left. However, this is not the case. In both lexical exceptional stems with (at least) 5 syllables and compounds with (at least) a trisyllabic second component with null nominative singular inflection, disyllabic inflection causes a stress on the preantepenultimate syllable. As shown in (15) and (16), the penultimate foot (which is the head foot in the uninflected form) is aligned right, leaving an unfooted gap in the middle of the word.

(15) Faithfulness to primary stress under disyllabic inflection of exceptions

<table>
<thead>
<tr>
<th>a. probabilistyk-a</th>
<th>probability.theory-NOM.SG</th>
<th>(σσ)(σσ)(σσ)σ</th>
<th>(AGpc, KGpc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. probabilistyk-ami</td>
<td>probability.theory-INST.PL</td>
<td>(σσ)(σσ)(σσ)-(σσ)</td>
<td>(AGpc, KGpc)</td>
</tr>
</tbody>
</table>

(16) Faithfulness to primary stress under disyllabic inflection of compounds

<table>
<thead>
<tr>
<th>a. lokator</th>
<th>locator.NOM.SG</th>
<th>σ(σσ)</th>
<th>(AGpc, KGpc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. lokator-ami</td>
<td>locator-INST.PL</td>
<td>(σσ)(σσ)-(σσ)</td>
<td>(AGpc, KGpc)</td>
</tr>
<tr>
<td>c. radio-o + lokator-ami</td>
<td>radio-CPD + locator-INST.PL</td>
<td>(σσ)+(σσ)(σσ)-(σσ)</td>
<td>(AGpc, KGpc)</td>
</tr>
<tr>
<td>d. *radio-o + lokator-ami</td>
<td>radio-CPD + locator-INST.PL</td>
<td>*(σσ)+(σσ)(σσ)-(σσ)</td>
<td>(AGpc, KGpc)</td>
</tr>
</tbody>
</table>

These facts follow from the dominance of the proposed IDENT-PWd constraint over ALIGN-Ft-L, as shown in (17) (for compounds; exceptions work in the same way). The initial stress in (16b) follows because the stem is PUnit-initial and thus has a foot aligned to its left edge by the dominance of ALIGN-PU-L over IDENT-PWd. That this doesn’t occur in (16) implies that any constraint requiring a foot at the left edge of the PWord cannot be active, i.e. must be dominated by IDENT-PWd.

(17) Predictions for compounds with disyllabic inflection (modified monostratal)

<table>
<thead>
<tr>
<th>{{(σσ+σσσ-σσσ)}}</th>
<th>IDENT-PWd</th>
<th>ALIGN-Ft-L</th>
</tr>
</thead>
<tbody>
<tr>
<td>![a] (σσ)+(σσ)(σσ)-(σσ)</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>![b] *(σσ)(σσ)(σσ)-(σσ)</td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>
4.3 Regularization of exceptions

It was established in Section 3.3 that the monostratal analysis cannot readily explain why derivation causes regularization of exceptional stress patterns whereas inflection does not. While the introduction of a phonological domain that is sensitive to derivational morphology could solve this problem, it is not clear how this domain would be represented in non-derived words. One possible workaround is that regularization of exceptional stress is not a concern of the phonology. If regularization affects only derived words, and derivation is taken to create a new lexical entry, then it could be assumed that the aspect of derivation which causes erasure of the lexical diacritics yielding exceptional stress occurs pre-phonologically. The derivational history of a stem (i.e. the derivational boundaries) may be retained for reference by the phonology without exceptional lexical diacritics.

An objection to this proposal can be raised on empirical grounds due to the fact that regularization also affects non-derived words. Specifically, exceptional stresses in the second component of a compound are regularized, as in (18). However, the same is not true of the first component of a compound: there, exceptional stresses are preserved (19).

(18) Regularization in the second component of compounds

a. prezydent
   president. NOM.SG
   \((\sigma\sigma)\sigma\)  
   (Comrie 1976)

b. \(\otimes\) pseud-o + prezydent
   pseudo-CPD + president. NOM.SG
   \((\sigma\sigma) + \sigma(\sigma\sigma)\)  
   (AGpc, KGpc)

c. * pseud-o + prezydent
   pseudo-CPD + president. NOM.SG
   \(* (\sigma\sigma) + (\sigma\sigma)\sigma\)  
   (AGpc, KGpc)

(19) Exceptional stress in the first component of compounds

a. rzeczpospolit-a
   republic- NOM.SG
   \((\sigma\sigma)(\sigma\sigma)\sigma\)  
   (Comrie 1976)

b. \(\otimes\) rzeczpospolit-o + korupcja
   republic-CPD + corruption
   ‘republican corruption’
   \((\sigma\sigma)(\sigma\sigma)(\sigma + \sigma)(\sigma\sigma)\)  
   (AGpc, KGpc)

c. * rzeczpospolit-o + korupcja
   republic-CPD + corruption
   \(* (\sigma\sigma)\sigma(\sigma\sigma) + \sigma(\sigma\sigma)\)  
   (AGpc, KGpc)

This asymmetry makes it impossible to claim that the lexical diacritic causing exceptional stress is erased wholesale in compounds, as it appears to be in derived words. The diacritic must be erased in the second component for regularization, but must be present in the first component for exceptionality. If the diacritic were present in the second component, Unstr-IK would have to be ranked below Align-MWD-R in order to yield exceptionality – but this would predict no exceptional primary stress anywhere, contra (2)–(4). If the diacritic were absent in the
first component, exceptional stress patterns could only be maintained if \textsc{ident-pwd} dominated \textsc{align-pwd-r}, which would predict exceptional stress patterns in all first components with null nominative singular inflection, contra (14)$^{10}$. The only way to deal with this asymmetry is to subject the components of a compound to different phonological treatment, which is not possible in the monostratal analysis because they are both PWords and thus receive identical treatment.

4.4 Variation

4.4.1 Variation in compounds with exceptional 4-syllable first component

It was shown in (19) that a P/A stem in the first component of a compound is expected to show an exceptional stress on its antepenult. This is not consistently seen when the first component has 4 syllables. In this case, variation exists between antepenult stress and initial stress, as illustrated in (20).

(20) Variation in compounds with a 4-syllable exceptional first component

\begin{enumerate}
  \item a. gramatyk-a
  \begin{align*}
    &\text{grammar-nom.sg} \\
    &\sigma(\sigma\sigma)-\sigma
  \end{align*}
  \quad (\text{Rubach and Booij 1985})
  \\
  \item b. \circ gramatyk-o + pis \sim gramatyk-o + pis
  \begin{align*}
    &\text{grammar-cpd + write} \\
    &'\text{grammar-writer'}
  \end{align*}
  \quad (\text{AGpc, KGpc})
  \\
  \item c. \circ gramatyk-o+znawc-a \sim gramatyk-o+znawc-a
  \begin{align*}
    &\text{grammar-cpd+expert-nom.sg} \\
    &'\text{grammar-expert'}
  \end{align*}
  \quad (\text{AGpc, KGpc})
\end{enumerate}

These observations cannot follow from \textsc{unstr-ik}, as the formation of a binary foot at the right edge of the MWord precludes the possibility of having the lexically-marked weak syllable (with nucleus $y$) as head of a binary foot. Were the variation to hold only in cases where the second component is monosyllabic (20b), the variation would follow from the free ranking of \textsc{align-pwd-r} with \textsc{align-pu-l} already motivated for compounds with a trisyllabic first component (7g). But, as discussed in Section 3.3, this prediction is not specific to compounds with exceptional first components and is instead made for all compounds with a 4-syllable first component and monosyllabic second component, as shown in the tableau in (21). Such variation is not observed (22).

(21) Predictions for compounds with a 4-syllable first component and monosyllabic second component (monostratal, modified)

\begin{tabular}{|c|c|c|}
\hline
\{\langle(\sigma\sigma\sigma\sigma)+(\sigma)\rangle\} & \textsc{align-pwd-r} & \textsc{align-pu-l} \\
\hline
\textcircled{a}. \sigma(\sigma\sigma)(\sigma+\sigma) & **! & \textcircled{b}. \sigma(\sigma\sigma)(\sigma+\sigma) & * & *! \\
\hline
\end{tabular}

$^{10}$In the specific case of (19), the stress pattern could also be obtained by ranking \textsc{parse-syll} above \textsc{align-pwd-r}; however, this would predict that compounds could never contain a gap in each of the components, contra (7a–7b).
Lack of variation in compounds with a 4-syllable non-exceptional first component and monosyllabic second component

a. \( j_{\text{eden}} \)
   \( \text{NOM.SG} \)
   \( \text{eleventh} \)

b. \( j_{\text{eden}} + \text{kat} \)
   \( \text{NOM.SG} \)
   \( \text{angle} \)
   \( \text{CPD} \)
   \( \text{eleventh - angle} \)
   \( \text{shape} \)
   \( \text{Kraska-Szlenk 2003} \)

c. \( * j_{\text{eden}} + \text{kat} \)
   \( \text{NOM.SG} \)
   \( \text{angle} \)
   \( \text{CPD} \)
   \( \text{eleventh - angle} \)
   \( \text{shape} \)
   \( \text{AGpc, KGpc} \)

d. \( \text{wieloryb} \)
   \( \text{NOM.SG} \)
   \( \text{whale} \)

Since the observations in (20) hold generally for all compounds with a 4-syllable exceptional first component (regardless of the size of the second component), the involvement of IDENT-PWD is required. Absent the influence of ALIGN-PWD-R, the variation would follow from free ranking of IDENT-PWD with respect to ALIGN-PU-L. In order to predict any variation at all (here and in (7g)), ALIGN-PWD-R would have to be dominated by (or freely ranked with respect to) these constraints, as shown in the tableau in (23) (\( \sigma \) designates a weak syllable, i.e. one triggering exceptional stress).

(23) Predictions for compounds with a 4-syllable exceptional first component (monostral, potential)

<table>
<thead>
<tr>
<th></th>
<th>ALIGN-PU-L</th>
<th>IDENT-PWD</th>
<th>ALIGN-PWD-R</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>( (\sigma\sigma\sigma) + (\sigma) )</td>
<td>***!*</td>
<td>**</td>
</tr>
<tr>
<td>b.</td>
<td>( \sigma(\sigma\sigma)(\sigma + \sigma) )</td>
<td>*!</td>
<td>**</td>
</tr>
<tr>
<td>c.</td>
<td>( \sigma(\sigma\sigma)(\sigma + \sigma) )</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This analysis has the advantage that it predicts variation in compounds with a trisyllabic first component (7g), because IDENT-PWD favors the medial stress seen in the first component standing alone whereas ALIGN-PU-L favors an initial stress. It also predicts no variation in general in compounds with a 4-syllable first component and monosyllabic second component, because both IDENT-PWD and ALIGN-PU-L favor initial stress. However, it still has an overgeneration problem. It would predict antepenultimate stress to be acceptable in the first component of a compound whenever that component has null nominative singular inflection, contra (14c) and (22f). Thus, the issue of stress variation in compounds with a 4-syllable exceptional first component is one that the monostral analysis, as presented, cannot easily address.
4.4.2 Variation in non-compounds under disyllabic inflection

The ranking established in Sections 4.1–4.2 predicts that a right-aligned medial foot will be seen in non-exceptional non-compounds under disyllabic inflection, provided they are (at least) 5 syllables long and have a null inflection in the nominative singular. The evidence is divided on this point. It certainly seems to be possible to find such words with left-aligned feet (24b). However, these forms may exist in variation with forms with right-aligned feet (24d). My informants showed a strong preference for the right-aligned variants (24f–24g), consistent with the prediction from the ranking established so far.

(24) Faithfulness to primary stress under disyllabic inflection of non-exceptional words

a. \[\text{organizer} \rightarrow (\sigma\sigma)\sigma(\sigma\sigma)\] organizer.NOM.SG

b. \[\text{organizer-ami} \rightarrow (\sigma\sigma)(\sigma\sigma)\sigma-(\sigma\sigma)\] organizer-INST.PL

Cetnarowska 2000

c. \[\text{akompaniator} \rightarrow (\sigma\sigma)\sigma(\sigma\sigma)\] accompanist.NOM.SG

Hayes 2009, 288

d. \[\text{akompaniator-owie} \sim \text{akompaniator-owie} \rightarrow (\sigma\sigma)(\sigma\sigma)\sigma-(\sigma\sigma)\sim (\sigma\sigma)\sigma(\sigma\sigma)-(\sigma\sigma)\] accompanist-NOM.PL

Hayes 2009, 288

e. \[\text{administrator} \rightarrow (\sigma\sigma)\sigma(\sigma\sigma)\] administrator.NOM.SG

AGpc, KGpc

f. \[\text{administrator-ami} \rightarrow (\sigma\sigma)\sigma(\sigma\sigma)-(\sigma\sigma)\] administrator-INST.PL

AGpc, KGpc

g. \[\text{*administrator-ami} \rightarrow *\sigma(\sigma\sigma)\sigma-(\sigma\sigma)\] administrator-INST.PL

AGpc, KGpc

If this is a case of variation, then it appears to contrast the pressures of ALIGN-Ft-L with those of IDENT-PWd: the former favors left-alignment, while the latter favors right-alignment. It could be accounted for by freely ranking these two constraints with respect to one another, as shown in the tableau in (25).

(25) Predictions for long words with null nominative singular under disyllabic inflection (monostratal, potential)

<table>
<thead>
<tr>
<th>{[(\sigma\sigma\sigma\sigma-\sigma\sigma)]}</th>
<th>IDENT-PWd</th>
<th>ALIGN-Ft-L</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ((\sigma\sigma)(\sigma\sigma)\sigma(\sigma\sigma))</td>
<td><em>!</em></td>
<td>7</td>
</tr>
<tr>
<td>b. ((\sigma\sigma)\sigma(\sigma\sigma)(\sigma\sigma))</td>
<td>*</td>
<td>8!</td>
</tr>
</tbody>
</table>
However, this would predict it to be acceptable to be unfaithful to rhythmic stress in compounds, contra (12c). Thus, the issue of stress variation in long words with null nominative singular under disyllabic inflection is also one that the monostratal analysis, as presented, cannot easily address.

Note that the words in (24) are all borrowings from English words denoting agents (typically in -er) and end with -ator. It is unclear whether the observed variation applies only to such borrowings in -ator or whether it is a more general property of 5+-syllable words which end in a consonant and have null nominative singular inflection. If the variation is specific to words in -ator, then it could be due to the presence of -ator. Waszakowa (1991) classifies -ator as a foreign derivational suffix on the basis of its recurrence in more than 100 Polish words and its clear semantic contribution to those words. As it is a non-native suffix, it is plausible that some speakers do not treat it in the same way as they would a native suffix, and this morphological variation could give rise to the phonological variation. However, the monostratal analysis has no way of capturing this possibility, as suffixes — whether native or non-native, derivational or inflectional — are all equally incorporated into the PWord.

4.5 Summary of implications for the monostratal analysis

The novel data have established that a faithfulness relation must exist between the PWord and MWord, just as Kraska-Szlenk (2003) argues it must exist between the MWord and PUnit. Faithfulness to the PWord affects only non-peripheral feet, by virtue of the ranking of IDENT-PWd below ALIGN-MWd-R and ALIGN-PU-L. It is evidenced in appropriate environments in compounds and in words with disyllabic inflection.

The novel data have also established several patterns that are difficult to reconcile with the monostratal analysis. Firstly, there is an asymmetry in the regularization of exceptional stress in different components of a compound. The monostratal analysis struggling to explain this because it cannot subject the components to different phonologies. Secondly, there is variation in the stress pattern of compounds with a 4-syllable exceptional first component. Attempts to predict this variation by free ranking of alignment and faithfulness constraints yield overgeneration, because the monostratal analysis does not treat lexical exceptions sufficiently differently than regular stems. Thirdly, there appears to be variation in the application of faithfulness to long borrowings ending in the derivational suffix -ator under disyllabic inflection, or perhaps more generally in long words with null nominative singular in this environment. The monostratal analysis cannot account for the specific case of words in -ator because it does not treat any suffixes specially, and it cannot for the potential general case without also incorrectly predicting variation in the application of faithfulness to compounds, as it does not approach inflection and compounding sufficiently differently.

The novel data have thus established that an additional faithfulness mechanism is required by the monostratal analysis, as are several mechanisms which are incompatible with its fundamental basis. In the next section, I present a multistratal analysis which attempts to provide such mechanisms in a well-founded fashion, yielding efficient coverage of a larger amount of data.

5 A multistratal OT analysis

The multistratal structure of the analysis is inspired by the relations between the prosodic domains (PWord, MWord, PUnit) identified in the monostratal analysis. Recall that the same basic
alignment template is assigned to each of these domains: a foot at the right, a foot at the left, and rhythmic feet aligned left inbetween. With one exception (to be discussed momentarily), the constraints assigning this structure in the monostatal analysis are ranked in decreasing order of prosodic domain size, so that the template is prioritized more in larger domains. However, it has also been shown that there are faithfulness relations between these domains, which protect non-peripheral foot structure from a smaller domain within a larger domain. This generalization can be captured efficiently by assuming that each of the domains (approximately) corresponds to a phonological stratum where precisely the same set of constraints enforces the template, and where Input-Output faithfulness protects the non-peripheral structure that is assigned in the progression from smaller domains (earlier strata) to larger ones (later strata). The use of strata also allows for subtly different phonological evaluation of different morphological units, meaning that attested asymmetries such as derivation versus inflection and first versus second component of a compound can be captured simply by the mapping of morphological units to phonological strata.

The exception to the generalization that constraints assigning templatic stress at different domains in the monostatal analysis are ranked in decreasing order of domain size is that Align-MWd-R dominates Align-PU-R. This ranking ensures that a single enclitic does not affect the foot at the right edge of the MWord. Since this foot is inevitably the head foot (due to Edge-R) the exception can be safely removed with the adoption of an additional theoretical assumption concerning head feet. If head feet are assumed to represent distinct entities to non-head feet and thus permitted to be independently referred to by alignment or faithfulness constraints (as opposed to separating the constraints for foot placement and prominence), then Align-PU-R may be ranked above Align-MWd-R in the monostatal analysis, provided there is a higher-ranked constraint forming a head foot at the right edge of the MWord. This higher-ranked constraint may be an alignment constraint or a faithfulness constraint analogous to Ident-MWd. In the multistatal approach, domain boundaries are not visible to constraints and thus there is no way to formulate an alignment constraint that ensures the head foot is aligned to the right of the MWord but no further, as is required for any case of encliticization (9). Thus, the head foot must be confined to the right edge of the clitic host (MWord) in the multistatal analysis by a faithfulness constraint at the cliticization stratum stating that the head foot in the input (MWord) should also be head in the output (PUnit).

With the assumption of theoretical distinction of head feet from non-head feet and the ability to specifically target head feet with faithfulness constraints, a new possibility arises for accounting for lexical exceptionality (and its erasure): the sites of exceptional stress are lexically marked head feet, as illustrated in (26).

(26) Lexically specified head feet in exceptional stems
   a. P/A stems: \(\cdots \sigma(\sigma\sigma)\)
   b. A/P stems: \(\cdots (\sigma\sigma)\sigma\)
   c. F/P stems: \(\cdots \sigma\sigma(\sigma)\)

This allows for the preservation of exceptional stress under inflection to be given the same treatment as the preservation of primary stress under encliticization: both are due to faithfulness

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11 The precise way in which the theory represents head feet as distinct entities is undetermined and immaterial for this discussion; I will simply assume them to carry a diacritic.

12 The notion that lexical exceptions in Polish are marked with a diacritic that attracts stress, rather than one which repels stress (Comrie 1976) or triggers extrametricality (Halle and Vergnaud 1987), has previously been advocated by Hammond (1989).
to head feet. By contrast, regularization of exceptional stress under derivation takes place because head foot status is erased and the regular stress template takes over. This underscores that the differences between derivation, inflection and compounding are driven by differences in the treatment of head feet: head feet are erased at derivation, yielding regularization; the rightmost foot is assigned head status at inflection, with complete right-alignment blocked by faithfulness to a pre-existing head foot one syllable from the right edge; and head feet are protected by faithfulness at cliticization. These differences are captured in the multistratal analysis by positing a stratum corresponding to each of derivation, inflection, and cliticization, and by having the same set of constraints in each stratum, with minor re-ranking of the constraints referring to head feet.

5.1 Strata

The multistratal analysis consists of three ordered strata, which I will refer to as Stratum 1, Stratum 2, and Stratum 3. The input to Stratum 1 is a sequence of syllables which is unfooted, except for lexical exceptions, which contain a lexically-marked head foot. The output of Stratum 1 forms input to Stratum 2, and the output of Stratum 2 forms input to Stratum 3. The output of Stratum 3 is the surface form output by the phonology.

Each stratum consists of an OT phonology. The same set of constraints, detailed in Section 5.2, exists at each stratum. Most of these constraints are fixed in the same ranking across all strata and yield the basic stress template (with exceptions as required by faithfulness). The rest concern head feet and have their ranking with respect to one another varied across strata, as discussed in Section 5.3.

Stratum 1 corresponds to derivation. At this stratum, head foot status is erased, yielding regularization of exceptional stress. The erasure of head foot status does not imply the erasure of the foot structure; a head foot in the input may survive as a non-head foot in the output in violation of the basic stress template if protected by faithfulness. Stratum 2 corresponds to inflection. At this stratum, a foot is aligned to the right (provided doing so does not interfere with a pre-existing head foot), and the rightmost foot is assigned head status. This yields exceptional stress for exceptional stems and regular primary stress for others. Stratum 3 corresponds to cliticization. At this stratum, the head foot output by inflection is preserved.

The asymmetrical behavior of exceptional stems in different components of compounds (18–19) suggests that the first component passes through Stratum 2 with the compound linking morpheme, while the second component passes through Stratum 1. The independent processing of the components both yields the asymmetry in terms of exceptional stress and ensures that both components have the potential to be faithful to their standalone foot structure, as in (7a) and (12). The two components then combine at Stratum 1, in order to allow for the compound to undergo derivational morphology if required. Following this, the compound is treated like any other stem as it undergoes inflection and (possibly) cliticization.

I assume that Stratum 1 only affects derived words and compounds, i.e. items which have undergone a corresponding morphological operation. Stratum 2 affects all words, as all words undergo inflection. Stratum 3 only affects cliticized words; however, all words may pass through

\[13\] Formally, this compositional procedure implies that the compound linking morpheme is an inflectional affix which yields a feature, [COMP], upon its combination with a stem. Any item with [COMP] is not licensed to appear on its own. Instead, the second component (which is typically the semantic and syntactic head of the compound; Szymamek 2009) selects for an item with [COMP] in the lexicon to derive a compound, in which [COMP] is cleared.

\[14\] I do not provide a specific mechanism through which this occurs; one possibility is for the stratum to only permit entry to derived words and compounds.
the stratum, with uncliticized words being unaffected due to the redundancy between the structure they were assigned at Stratum 2 and the structure that would be assigned by the constraints at Stratum 3.

5.2 Constraints

The constraints utilized at each stratum in the analysis are as follows:

- **Trochee**: Assign a violation for each foot whose head syllable is not aligned to the left.
- **Lapse**: Assign a violation for each pair of adjacent unfooted syllables in the output.
- **Culm**: Assign a violation if the output contains more than one head foot.
- **OblHead**: Assign a violation if the output contains no head foot.
- **HeadFt**: Assign a violation for each head foot in the output.
- **Head-R**: Assign a violation if the rightmost foot in the output is not head.
- **Max(HdFt)**: Assign a violation if the head foot in the input does not correspond to the head foot in the output (containing all and only the corresponding syllables).
- **FtBin**: Assign a violation for each foot that does not consist of two syllables.
- **Foot-R**: Assign a violation if there is not a foot at the right edge of the output.
- **Foot-L**: Assign a violation if there is not a foot at the left edge of the output.
- **Max(Ft)**: For each foot in the input, assign a violation if there is not a corresponding foot (containing all and only the corresponding syllables) in the output.
- **Feet-L**: For each foot, assign a violation for each unfooted syllable anywhere to its left.

5.3 Constraint rankings

I begin by assuming a fixed constraint ranking, which covers most of the data. In Section 5.5, I show how these rankings (and other assumptions) may be relaxed in order to account for attested variation.

The constraints are arranged in 3 blocks: undominated constraints, head-foot constraints, and foot-template constraints. Across all strata, the undominated constraint block dominates the head-foot constraint block, which dominates the foot-template constraint block, as illustrated in (27).

(27) Constraint block rankings across all strata

\[
\text{Undominated} \gg \text{Head-foot} \gg \text{Foot-template}
\]

The undominated constraint block consists of **Trochee**, **Lapse** and **Culm**. These are unranked with respect to one another, as illustrated in (28), as they are never violated.
Undominated constraint block (all strata)
{Trochee, *Lapse, Culm}

The head-foot constraint block consists of OblHead, *HeadFt, Head-R, and Max(HdFt). These constraints are ranked differently at different strata, as illustrated in (29). At Stratum 1 (29a), *HeadFt dominates all other constraints in the block, causing head foot status to be erased. At Stratum 2 (29b), OblHead dominates *HeadFt, ensuring that a head foot is in the output, and Head-R dominates Max(HdFt), ensuring that the rightmost foot will be head, but a pre-existing head foot will be preserved if it falls one syllable from the end. At Stratum 3 (29c), OblHead still dominates *HeadFt, but now Max(HdFt) dominates Head-R, ensuring that head foot status will be preserved rather than reassigned. I assume that constraint reranking occurs by way of constraint promotion, and thus preserve rankings from earlier strata even when they are not necessitated at later strata.

Head-foot constraint block
a. Stratum 1: *HeadFt ≫ {OblHead, Head-R, Max(HdFt)}
b. Stratum 2: {OblHead, Head-R} ≫ *HeadFt ≫ Max(HdFt)
c. Stratum 3: Max(HdFt) ≫ {OblHead, Head-R} ≫ *HeadFt

The foot-template constraint block consists of FtBin, Foot-R, Foot-L, Max(Ft), and Feet-L, ranked in that order across all strata, as illustrated (30). This ranking mirrors that seen in the monostratal analysis, ensuring that each stratum yields the basic stress template (1) and that non-peripheral feet from earlier strata are protected in later strata.

Foot-template constraint block (all strata)
FtBin ≫ Foot-R ≫ Foot-L ≫ Max(Ft) ≫ Feet-L

5.4 Demonstration of analysis
5.4.1 Basic word stress template
The assignment of the basic word stress template primarily takes place at Stratum 2. Non-derived stems are not affected by Stratum 1 and thus enter Stratum 2 with no established foot structure (apart from structure that is lexically marked in exceptions). Examples are shown in tableaux (31)–(33) (constraints that are not relevant for the present demonstration, and candidates violating them, have been omitted).

Stratum 2: unfooted monosyllabic input

<table>
<thead>
<tr>
<th>σ</th>
<th>OblHead</th>
<th>Head-R</th>
<th>*HdFt</th>
<th>FtBin</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. (σ)</td>
<td>✔</td>
<td></td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>
| b. (σ) | * | ✔ | * | *
| c. σ | * | | | |

(32) Stratum 2: unfooted trisyllabic input
(33) Stratum 2: unfooted 7-syllable input

<table>
<thead>
<tr>
<th>σσσσσσσ</th>
<th>*LAPSE</th>
<th>FtBin</th>
<th>Foot-R</th>
<th>Foot-L</th>
<th>Feet-L</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. σ(σσ)</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>b. (σσ)σ</td>
<td></td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
</tr>
<tr>
<td>c. (σ)σ(σσ)</td>
<td>*!</td>
<td></td>
<td></td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>d. (σσ)(σσ)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. σσσ</td>
<td><em>!</em></td>
<td></td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

(34) Stratum 2: footed 4-syllable stem with monosyllabic inflection

<table>
<thead>
<tr>
<th>(σσ)(σσ)-σ</th>
<th>FtBin</th>
<th>Foot-R</th>
<th>Foot-L</th>
<th>Max(Ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. (σσ)σ(σσ)</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. σ(σσ)(σσ)</td>
<td></td>
<td></td>
<td></td>
<td>*!</td>
</tr>
<tr>
<td>c. (σσ)(σσ)σ</td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. (σσ)(σσ)(σ)</td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. (σσ)(σσ)(σσ)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(35) Stratum 2: footed 5-syllable stem with monosyllabic inflection

<table>
<thead>
<tr>
<th>(σσ)σ(σσ)-σ</th>
<th>*LAPSE</th>
<th>FtBin</th>
<th>Foot-R</th>
<th>Max(Ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. (σσ)(σσ)(σσ)</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. (σσ)σ(σσ)σ</td>
<td></td>
<td></td>
<td>*!</td>
<td>*</td>
</tr>
<tr>
<td>c. (σσ)(σσ)(σσ)σ</td>
<td>*!</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>d. (σσ)(σσ)(σσ)(σ)</td>
<td><em>!</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. (σσ)σσ(σσ)</td>
<td>*!</td>
<td></td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>
(36) Stratum 2: footed 5-syllable stem with disyllabic inflection

<table>
<thead>
<tr>
<th>(σσ)(σσ)(σσ)σσ</th>
<th>*LAPSE</th>
<th>FtBin</th>
<th>Foot-R</th>
<th>Foot-L</th>
<th>MAX(Ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. (σσ)(σσ)(σσ)σσ</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. (σσ)(σσ)(σσ)σσ</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*!</td>
</tr>
<tr>
<td>c. σ(σσ)(σσ)(σσ)σσ</td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. (σσ)(σσ)(σσ)(σσ)σσ</td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. (σσ)(σσ)(σσ)(σσ)σσ</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*!</td>
</tr>
</tbody>
</table>

5.4.2 Lexical exceptions: irregularities, faithfulness, and regularization

Exceptional stems (Section 2.2) are assumed to contain a lexically specified head foot (26). When these stems do not undergo derivation, they are not altered by Stratum 1, and thus this head foot is present in the input to Stratum 2, where it is protected by \( \text{MAX(HdFt)} \). This is illustrated in tableaux (37)–(38).

(37) Stratum 2: exceptional antepenultimate stress

<table>
<thead>
<tr>
<th>σσ(σσ)(σσ)σσ</th>
<th>*LAPSE ; CULM</th>
<th>HEAD-R</th>
<th>MAX(HdFt)</th>
<th>FtBin</th>
<th>Foot-R</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. (σσ)(σσ)(σσ)σσ</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. (σσ)(σσ)(σσ)σσ</td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. (σσ)(σσ)(σσ)σσ</td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. (σσ)(σσ)(σσ)σσ</td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. (σσ)(σσ)(σσ)σσ</td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. σσ(σσ)(σσ)σσ</td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

(38) Stratum 2: exceptional final stress

<table>
<thead>
<tr>
<th>σσ</th>
<th>MAX(HdFt)</th>
<th>FtBin</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. σσ</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. σσ</td>
<td><em>!</em></td>
<td></td>
</tr>
<tr>
<td>c. σσ</td>
<td></td>
<td>*!</td>
</tr>
</tbody>
</table>

When inflection yields two (or more) syllables to the right of the lexically specified head foot, *LAPSE requires these syllables to be footed, and HEAD-R assigns this new foot head status. Since CULM permits only one head foot in the output, the lexically specified head foot loses its head foot status (39). However, it remains a foot under the protection of MAX(Ft), and surfaces as a non-right-aligned non-head foot if the word is long enough (40). In the case of F/P stems, faithfulness to the exceptional stress is not observed because MAX(Ft) is overruled by FtBin (41).

(39) Stratum 2: exceptional stem with 2 unfooted syllables at right edge from inflection

<table>
<thead>
<tr>
<th>σσ(σσ)(σσ)σσ</th>
<th>*LAPSE ; CULM</th>
<th>HEAD-R</th>
<th>MAX(HdFt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. (σσ)(σσ)(σσ)σσ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. (σσ)(σσ)(σσ)σσ</td>
<td></td>
<td></td>
<td>*!</td>
</tr>
<tr>
<td>c. (σσ)(σσ)(σσ)σσ</td>
<td></td>
<td></td>
<td>*!</td>
</tr>
<tr>
<td>d. (σσ)(σσ)(σσ)σσ</td>
<td></td>
<td></td>
<td>*!</td>
</tr>
<tr>
<td>e. σσ(σσ)(σσ)σσ</td>
<td><em>!</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.4.3 Compound stress and faithfulness under compounding

In a compound, the first component is not initially affected by Stratum 1. It passes through Stratum 2 with the linking morpheme -o- and has foot structure assigned according to the basic template (Section 5.4.1). It then re-enters Stratum 1 to be combined with the second component, with its existing foot structure preserved by $\text{Max(Ft)}$, as illustrated in tableau (43). The second component also has existing foot structure following the basic template due to an independent pass through Stratum 1.

(43) Stratum 1: preservation of component stresses in compounds
Since \( \text{Max(Ft)} \) is dominated by \( \text{Foot-R} \) and \( \text{Foot-L} \), peripheral feet in the first component are not preserved if doing so would yield an output compound without a foot at one of its peripheries. Thus, when the first component is monosyllabic, its unary foot becomes binary (44) or is removed in the specific case of a disyllabic second component (45); when the second component is monosyllabic, the final foot in the first component shifts rightwards (46); and when the first component is trisyllabic, its foot shifts leftwards (47). The possibility of variation in this last case (c.f. 7g) will be discussed in Section 5.5.1.

(44) Stratum 1: compounding with a monosyllabic first component

<table>
<thead>
<tr>
<th>(( \sigma ))+(( \sigma ))</th>
<th>*HeadFt</th>
<th>FtBin</th>
<th>Foot-R</th>
<th>Foot-L</th>
<th>Max(Ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( (\sigma \sigma) )</td>
<td></td>
<td>**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \sigma(\sigma \sigma) )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \sigma(\sigma \sigma) )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \sigma(\sigma \sigma) )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \sigma(\sigma \sigma) )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(45) Stratum 1: compounding with a monosyllabic first component

<table>
<thead>
<tr>
<th>(( \sigma ))+(( \sigma ))</th>
<th>*HeadFt</th>
<th>FtBin</th>
<th>Foot-R</th>
<th>Foot-L</th>
<th>Max(Ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \sigma(\sigma \sigma) )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \sigma(\sigma \sigma) )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \sigma(\sigma \sigma) )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \sigma(\sigma \sigma) )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \sigma(\sigma \sigma) )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(46) Stratum 1: compounding with a monosyllabic second component

<table>
<thead>
<tr>
<th>(( \sigma \sigma \sigma \sigma ))</th>
<th>*HeadFt</th>
<th>FtBin</th>
<th>Foot-R</th>
<th>Foot-L</th>
<th>Max(Ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \sigma(\sigma \sigma) )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \sigma(\sigma \sigma) )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \sigma(\sigma \sigma) )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \sigma(\sigma \sigma) )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \sigma(\sigma \sigma) )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(47) Stratum 1: compounding with a trisyllabic first component
Because compound formation occurs at Stratum 1, it precedes inflection at Stratum 2. A compound input to Stratum 2 thus has pre-existing foot structure, just as does a derived input. As a result, disyllabic inflection of a compound yields faithfulness to this foot structure, in precisely the same way as illustrated for disyllabic inflection of a derived stem (36). No such faithfulness is seen for monosyllabic inflection because there is no head foot to be preserved, due to *HeadFt dominating OBLHead and MAX(HdFt), and because the preservation of non-head feet is secondary to the requirement for a right-peripheral foot, due to FOOT-R dominating MAX(Ft). Compounds thus shift stress under monosyllabic inflection in precisely the same way as illustrated for derived stems (34).

If the first component is a lexical exceptional stem, it will enter the compound formation at Stratum 1 with a lexically-specified head foot (or non-right-aligned non-head foot that is faithful to this lexically-specified foot). While this foot will have its head status erased by *HeadFt, it will still be subject to MAX(Ft), provided it does not interfere with the left-aligned foot required by FOOT-L. Thus, exceptional stress is preserved in the first component of a compound, as illustrated in tableau (48).

(48) Stratum 1: exceptional stress preservation in the first component of a compound

<table>
<thead>
<tr>
<th>(σσ)σ(σσ)+σ(σσ)</th>
<th>*HeadFt</th>
<th>FtBin</th>
<th>Foot-R</th>
<th>Foot-L</th>
<th>Max(Ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>a.</strong> (σσ)σ(σσ)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. σ(σσ)(σσ)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*!</td>
</tr>
<tr>
<td>c. (σσ)(σσ)(σσ)</td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td>**</td>
</tr>
<tr>
<td>d. σ(σσ)(σσ)(σσ)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>e. σ(σσ)(σσ)(σσ)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

Since the second component passes through Stratum 1 independently before compound formation, it may never have a lexically-specified head foot, even if it is an exceptional stem. Instead, the second component will always have a non-head foot at its right edge, as in (42). Consequently, exceptional stress cannot be preserved in the second component of a compound.

### 5.4.4 Cliticization

Clitics attach (non-cyclically) at Stratum 3. The input to Stratum 3 has existing foot structure, including a head foot, as assigned at Stratum 2. Cliticization does not affect the placement of the head foot due to the dominance of MAX(HdFt) over markedness constraints such as FtBin and FOOT-R, as illustrated in tableaux (49)–(50).

(49) Stratum 3: head foot preservation under procliticization

<table>
<thead>
<tr>
<th>σ=[σ]</th>
<th>Max(HdFt)</th>
<th>FtBin</th>
<th>Foot-L</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>a.</strong> σ(σ)</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. (σ)(σ)</td>
<td></td>
<td></td>
<td>**!</td>
</tr>
<tr>
<td>c. (σσ)</td>
<td></td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

27
Stratum 3: head foot preservation under encliticization

When a sequence of clitics is attached, the existing feet in the input become non-peripheral and are protected by Max(Ft). The clitic sequence is assigned foot structure following the basic template due to the foot-template constraint block, as illustrated in tableaux (51)–(52). Feet formed over enclitics are not assigned head status due to the dominance of Max(HdFt) over Head-R.

Stratum 3: templatic stressing of proclitic sequences

When an enclitic attaches to a host with antepenultimate stress, it creates a site for a potential lapse, in violation of *Lapse. Consequently, this site is filled in by a non-head foot, as illustrated in tableau (53).

Stratum 3: monosyllabic encliticization to an antepenultimately-stressed host
The attachment of a single proclitic shifts the initial non-head foot of the host left due to the dominance of FOOT-L over MAX(Ft), as illustrated in tableau (54). Other feet in the host are preserved due to the dominance of MAX(Ft) over FEET-L.

(54) Stratum 3: stress shift with monosyllabic procliticization

<table>
<thead>
<tr>
<th>σ=(σσ)(σσ)(σσ)</th>
<th>FtBin</th>
<th>FOOT-L</th>
<th>MAX(Ft)</th>
<th>FEET-L</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. (σσ)(σσ)(σσ)σ(σσ)</td>
<td>*</td>
<td></td>
<td>*</td>
<td>***</td>
</tr>
<tr>
<td>b. (σσ)(σσ)(σσ)(σσ)</td>
<td></td>
<td>**!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. σ(σσ)(σσ)(σσ)(σσ)</td>
<td>*!</td>
<td></td>
<td></td>
<td>****</td>
</tr>
<tr>
<td>d. (σ)(σσ)(σσ)(σσ)(σσ)</td>
<td>*!</td>
<td>*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.5 Variation

5.5.1 Variation in compounds with trisyllabic first component

Variation in foot placement in a trisyllabic first component of a compound with a polysyllabic second component (7g) can be obtained by free ranking of FOOT-L and MAX(Ft). This free-ranking must be observed at Stratum 1 to yield variation when the compound is first formed (c.f. 47) and must be maintained at Stratum 2 in order not to remove the candidacy of the right-aligned variant. If non-cliticized forms are assumed to pass through Stratum 3, then this ranking must also hold there, where it predicts similar variation to be possible when a single proclitic attaches to a host of 4 or more syllables (c.f. 54). To some extent, my informants confirmed the possibility of this variation, indicating that lack of stress shift under procliticization becomes increasingly acceptable as the length of the host grows (55)

(55) Increasing acceptability of lack of stress shift under procliticization

a. * do = ²₁ profesor-a
   to = professor-GEN.SG
   *σ=(σσ)(σσ)(σσ)
   (AGpc, KGpc)

b. ? do = ²₁ saksofon-γ
   to = saxophonist-GEN.SG
   ?σ=(σσ)(σσ)(σσ)
   (AGpc, KGpc)

c. do = ²² ᵃ₁ Amerýkanin-a
   to = American-GEN.SG
   σ=(σσ)(σσ)(σσ)(σσ)
   (AGpc, KGpc)

d. do = ²² ᵃ₁ wyalienowane-go
   to = alienated-GEN.SG
   σ=(σσ)(σσ)(σσ)(σσ)
   (AGpc, KGpc)

Free ranking of FOOT-L and MAX(Ft) also makes the undesirable prediction that a left-aligned foot need not always be seen in compounds with a monosyllabic first component (c.f.

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The length-sensitivity of this phenomenon may be related to stress prominence, under the assumption that the initial stress is more prominent in longer words. This effect is unable to be captured in the present analysis, which makes a binary distinction between primary and non-primary stress. However, the relevant point for the present analysis is simply that (constrained) variation exists in this domain.
44). While this, too, may be length-sensitive (as AG did accept the pattern $\sigma+(\sigma\sigma)(\sigma\sigma)(\sigma\sigma)$ for *dwu+rewolucjonista*) and simply not evident in the literature due to the focus on compounds with short components\(^{16}\), it is worthwhile considering what means could be employed to ensure that compounds with a monosyllabic first component receive a left-aligned foot in the face of variation in other compounds. In other words, what additional assumptions can be made so that free ranking of Foot-$L$ and Max(Ft) does not predict variation in compounds with a monosyllabic first component?

One possibility is that the second component does not pass through Stratum 1 independently, but only in combination with the first component, so that the second component would not be footed in the input to compound formation. For compounds with a monosyllabic first component, the basic foot template would be assigned over the entire compound because the unary initial foot violates FtBin, and this would not cause repercussions for compounds with a trisyllabic first component. However, it would also predict that a compound with antepenultimate stress in the first component and a second component of at least 4 syllables would not leave a gap over the last syllable of the first component in order to align a foot at the left edge of the second component, but would rather fill this gap by aligning the medial foot left, which is incorrect (56).

(56) Inter-component gap in compounds with exceptional first component

a. $^2\text{matematyk-a}$
   mathematician-GEN.SG  \((\sigma\sigma)(\sigma\sigma)\sigma\)  \(\text{(Comrie 1976)}\)

b. $^2\text{matematyk-o} + ^2\text{geodeta}$
   mathematician-CPD + surveyor.NOM.SG  \((\sigma\sigma)(\sigma\sigma)\sigma+(\sigma\sigma)(\sigma\sigma)\)  \(\text{(AGpc, KGpc)}\)

c. $^2\text{matematyk-o} + ^1\text{geodeta}$
   mathematician-CPD + surveyor.NOM.SG  \*(\sigma\sigma)(\sigma\sigma)(\sigma+\sigma)\sigma(\sigma\sigma)\)  \(\text{(AGpc, KGpc)}\)

A second possibility, taking inspiration from Kraska-Szlenk’s (2003, 66) Ident-Prom, is that the faithfulness constraint protecting foot structure from one stratum to the next could operate not on entire feet but rather on head syllables of feet. Thus, the equivalent of Max(Ft) would be violated only when a syllable that is the head of some foot in the input is not the head of some foot in the output. As a result, the expansion of a unary foot to binary would not incur any violation, and the stress in the first component and the initial stress in the second component would both receive equal treatment from the faithfulness constraint, with Foot-$L$ adjudicating between them in favor of a left-aligned foot (word-initial stress). In this way, the equivalent of Max(Ft) may be freely ranked with respect to Foot-$L$ without predicting variation for compounds with a monosyllabic first component.

5.5.2 Variation in compounds with exceptional 4-syllable first component

In compounds with a 4-syllable first component with exceptional antepenultimate stress, variation is observed between the retention of the antepenultimate stress in the first component and initial stress (20). This variation would follow from free-ranking of Foot-$L$ and Max(Ft) at all strata,

\(^{16}\)The longest relevant compound presented by Kraska-Szlenk (2003) has just 4 syllables in the second component. By analogy with (55), a component this short may not be expected to resist stress-shift phenomena.
as motivated in Section 5.5.1. The question to be addressed here is how the undesirable other predictions made by this ranking could be avoided without interfering with the capacity for the free-ranking of FOOT-L and MAX(Ft) to generate desirable variation.

In Section 5.5.1, it was suggested that the variation obtained from free ranking of FOOT-L and MAX(Ft) could be constrained by reformulating MAX(Ft) to be sensitive only to stressed syllables (i.e. heads of feet), rather than entire feet. This would have no negative repercussions for the variation in compounds with an exceptional 4-syllable first component, as that variation does not draw on the difference between unary and binary feet (which is the difference collapsed by the redefinition of the constraint). Thus, it is possible to generate variation in compounds with a 4-syllable first component with exceptional antepenultimate stress without overpredicting variation in other cases.

5.5.3 Variation in non-compounds under disyllabic inflection

Some evidence suggests that stems of (at least) 5 syllables ending in -ator show variation in medial foot placement under disyllabic inflection (24). Either the medial foot is left-aligned, where it would be expected under the general foot template, or it is right-aligned, where it would be expected in the corresponding nominative singular. It is unclear whether this is specific to stems in -ator or whether it is a more general property of stems which end in a consonant and have a null nominative singular inflection. Either way, it is potentially problematic for the stratal analysis, as derived stems (i.e. stems in -ator) are predicted invariably to yield the right-aligned variant (c.f. 36), whereas non-derived stems are predicted invariably to yield the left-aligned variant (c.f. 33).

If the variation is constrained to stems in -ator (and similar foreign derivational suffixes), two solutions are possible. Firstly, there could be variation in the morphological analysis of the stem: some speakers could treat -ator as a derivational suffix, while others could not due to its foreign status. Treating -ator as a derivational suffix would mean that the stem is assigned foot structure at Stratum 1 which is preserved at Stratum 2 by MAX(Ft), whereas treating it non-derivationally would mean that the stem is not assigned foot structure at Stratum 1 and thus is assigned the basic foot template at Stratum 2. Secondly, all speakers could treat -ator as a derivational suffix, and FOOT-R could be freely ranked with respect to FEET-L at Stratum 1. This would not upset later enforcement of the general foot template due to FOOT-R being ranked higher at later strata. However, it would predict similar variation under disyllabic inflection in all derived words and compounds of sufficient length, and I do not have adequate data to assess this prediction.

If the variation is observed generally in non-derived stems which end in a consonant and have a null nominative singular inflection, then accounting for it would require positing that such stems may sometimes enter Stratum 2 with an existing (non-head) foot at their right edge. While it would suffice to claim this foot to be lexically-marked, doing so seems ad-hoc. Consequently, it must be put in place by a stratum: either Stratum 1 or Stratum 2. Claiming the foot to result from Stratum 1 would require claiming that, sometimes or for some speakers, all stems pass through Stratum 1. This would predict that non-derived lexical exception words sometimes surface with regular stress, as Stratum 1 erases the head foot status that causes their exceptionality. While this may be the case for relatively infrequent exceptions, it is unlikely for frequent, firmly-entrenched exceptions. The alternative is to claim that the foot results from Stratum 2. This requires claiming that, sometimes or for some speakers, stems pass through Stratum 2 prior to inflection, just as the second component of a compound passes through Stratum 1 prior to compounding. However, this, too, would make false predictions. Since Stratum 2 assigns head foot status to the rightmost foot (due to the dominance of OblHead and Head-R over *HeadFt), and also
protects established head feet in the input (due to the dominance of $\text{MAX(HdFt)}$ over $\text{Foot-R}$), monosyllabic inflection of any word would be predicted to yield a variant where primary stress is antepenultimate rather than penultimate. Clearly, this is not the case. Thus, if variation is observed generally in non-derived stems which end in a consonant and have a null nominative singular inflection, then the multistratal analysis will face the same struggle as the monostratal analysis (Section 4.4.2).

6 Discussion

The monostratal and multistratal analyses are very similar, differing only in terms of a few key assumptions. These differences result in different extents of coverage of the data (both existing and novel). The monostratal analysis is incapable of generating patterns or variation that require differential treatment of different kinds of inputs (e.g. derived versus inflected; first versus second component of a compound), whereas the multistratal analysis is capable of making these distinctions without losing the similarities, and thus obtains greater coverage. In this section, I discuss the differences in assumptions between the analyses that lead to this difference in coverage, and I evaluate the additional assumptions permitted by the stratal analysis.

6.1 Domains, strata, alignment, and faithfulness

It is clear from the data in the literature (Section 2) that an analysis of Polish word stress requires alignment of feet at different-sized morphological units, and faithfulness between noncliticized and cliticized words. The novel data (Section 4) also makes clear the need for faithfulness between uninflected (or unmarkedly-inflected) and inflected forms. The monostratal analysis meets these needs by introducing prosodic domains (approximately) corresponding to these morphological units and allowing alignment and faithfulness constraints to be parameterized with respect to these domains, while the multistratal analysis does it by having one stratum per morphological unit and enforcing an identical set of alignment and faithfulness constraints at each stratum. These approaches are very similar in essence.

It could be argued that the multistratal analysis introduces unnecessary complications by repeating the same constraints at different strata. For example, Kraska-Szlenk (2003, 75) argues that it is unnecessary to assign left-aligned feet at any domain smaller than the PUnit (which includes the word and any attached clitics) because the left-alignment at smaller domains follows from the nested nature of the domains. As a result, the monostratal analysis need only propose one of each kind of left-alignment constraint as active, as left-alignment supposedly need only be applied once. However, this only holds because of the faithfulness constraints: in the monostratal analysis, any smaller domain (MWord or PWord) is faithful to the way it would surface standing alone, in which case it would receive left-aligned feet by virtue of constituting a PUnit. Thus, though there is no actual constraint enforcing left-alignment in these smaller domains, implicit reference to the application of a left-alignment constraint in those domains (via Output-Output faithfulness) is nevertheless required. Consequently, repeating the same constraints at different strata in the multistratal analysis does not introduce any constraint-based processes that were not already present – it merely makes them explicit.

The MWord and PUnit domains in the monostratal analysis correspond exactly to the output of Strata 2 and 3 (respectively) in the multistratal analysis, but the correspondence is not exact between the PWord domain and Stratum 1. The PWord domain includes all suffixes non-recursively,
while Stratum 1 attaches (derivational) suffixes cyclically. This difference yields different predictions; for example, it permits foot alignment to the right edges of nested morphological Stem units in the multistratal analysis, but not in the monostratal analysis. Novel data (Section 4.4.2) suggest that such alignment is required at least in some cases. Extending the monostratal analysis to account for this fact would require introducing recursion in the PWord for suffixes, but then the PWord would simply constitute a relabeling of morphological structure. The multistratal account takes advantage of morphological structure directly, without relabeling, and may be considered more efficient in this respect.

6.2 Head feet

The two analyses differ in terms of their treatment of head feet. Both assume that head feet are feet with an additional property (i.e., that of being most prominent); head-foot alignment thus operates in terms of foot structure present in the output. In the multistratal analysis, head-foot alignment is not absolute, but relative; a head foot is not required to be anywhere in particular in the output, but the rightmost foot in the output is required to have head status. In the monostratal analysis, head-foot alignment is also relative, but it is constrained by absolutes in the form of domain boundaries; the rightmost foot in the MWord is required to have head status. This domain-sensitivity is translated in the multistratal analysis by a faithfulness constraint that is specific to head feet.

A head-foot faithfulness constraint may seem ad-hoc or theoretically undesirable, but it is in a sense equivalent to domain-sensitive head-foot alignment. Consider the basic assumptions of a stratal approach, translated into the language of a domain-parameterized monostratal approach. Every constraint is parameterized for each domain. In Kraska-Szlenk’s (2003) monostratal analysis, any ranking can hold between these constraints, but in the monostratal equivalent of the multistratal analysis, the rankings are highly constrained. Within each family of the domain parameterizations of a particular alignment constraint, the ranking is in order of decreasing domain size. Conversely, within each family of the domain parameterizations of a particular faithfulness constraint, the ranking is in order of increasing domain size. Fundamental differences in the phonological processes applying at different domains are obtained by interweaving these constraint families in different ways. The only way that an alignment constraint may be active at a domain \( D \) that is not the largest is if it ranks above the corresponding faithfulness constraints for any domain larger than \( D \), and if the corresponding faithfulness constraint for \( D \) ranks above the alignment constraint for the largest domain. Thus, the requirement for head-foot alignment to be constrained by the MWord necessitates the existence of a family of faithfulness constraints protecting head feet, and fixes their ranking with respect to the family of head-foot alignment constraints. The introduction of additional faithfulness constraints in this framework is not ad-hoc, but simply a formal equivalent to free-ranking of domain-parameterized alignment constraints within a system that does not permit free-ranking. Since the multistratal approach simply collapses the redundancy in this monostratal approach, the introduction of a head-foot faithfulness constraint there should not be seen as ad-hoc either.

The question then remains: how could head-foot faithfulness be incorporated within a formal metrical theory? I have treated the head status of a foot as a diacritic, but it could be represented in other ways, such as the tallest tower of asterisks in a grid-theoretic approach. In such an approach, head-foot faithfulness would be translated as a constraint stating that the tallest tower of asterisks in the input must also be the tallest tower in the output. If asterisk levels were fixed – for example, in order to make only 3-way distinctions in syllable prominence – then a particular
layer would designate head foot status, and faithfulness could be implemented as a constraint against erasing or shifting the asterisk in that layer. I contend that these suggestions are no less theoretically dissatisfying than requiring the metrical theory to represent and be sensitive to domain boundaries, as is required in the monostratal analysis.

6.3 Lexical exceptions and (non-)derivation

The two analyses also differ in their treatment of lexical exceptions. Both view exceptionality as being triggered by a lexical diacritic, but they differ on the nature of this diacritic: in the monostratal analysis, certain syllables are marked as “weak” and repel stress, while in the multi-stratal analysis, certain syllables are marked as “strong” and attract stress (in particular, through lexically-marked head feet). Kraska-Szlenk (2003) attempts to identify the weakness of exceptional words with the weakness of certain clitics. However, she is forced by the details of her analysis to assume that different constraints, ranked differently, are responsible for each. By contrast, in the multistratal analysis, the preservation of stress in exceptional words is identified with the preservation of head feet, utilizing the same constraint.

The multistratal analysis is uniquely able to predict the regularization of exceptional stress under derivation, as it encodes the difference between derivation and inflection in the difference between Stratum 1 and Stratum 2. Head feet are assumed to be prohibited in the output of Stratum 1 (i.e. following derivation), whereas they are assumed to be protected (via faithfulness) in Stratum 2. The prohibition of head feet yields flat stress structures, which are purported to exist in some languages (Hyman 1977); flat structures are not observed here because head foot status is obligatorily assigned at Stratum 2. The lack of regularization in non-derived lexical exceptions has been taken to imply that stems are only affected by Stratum 1 when derived. This is analogous to well-known non-derived environment blocking effects, and I have suggested it could take place through Stratum 1 only allowing derived words as input. Such an approach is consistent with a claim that the interweaving of morphology and phonology is driven by the features of morphemes: different kinds of morphemes trigger different phonologies.

6.4 Compounding

The treatment of compounds is perhaps the area in which the analyses differ most, but there, too, there are similarities. The monostratal analysis assumes that the components of a compound constitute separate PWords that are nested within one MWord. As a result, the compound as a whole displays the fundamental foot structure of an MWord, while each component also displays its own structure. Similarly, the multistratal analysis assumes that the components of a compound pass through strata independently before being combined at a later stratum. Foot structure assigned to the components independently is protected by faithfulness upon their combination. While the multistratal analysis yields a more recursive compound structure than the monostratal analysis, due to the combination of components at a stratum prior to inflection, this simply reflects the assumption in the monostratal analysis that suffixation does not yield recursive prosodic domains and the assumption in the multistratal analysis that moving backwards through strata is not permitted, so that the compound must be formed prior to Stratum 2 in order for it to be possible to be derived further. This difference could be lessened with no loss by assuming that, when compounds are not derived further, compound formation occurs in parallel with inflection at Stratum 2.
Because the monostratal analysis treats both components of a compound as PWords, they must be subject to the same phonology; thus, the asymmetries in terms of regularization of lexical exceptional components (Section 4.3) cannot be captured. By contrast, the multistratal analysis can predict the asymmetry by passing the components through different strata prior to compound formation: the first component through Stratum 2, which preserves exceptionality, and the second component through Stratum 1, which regularizes exceptionality. However, this may seem somewhat dissatisfying, as it requires the first component to backtrack from Stratum 2, where it receives its independent structure, to Stratum 1, where it is combined with the second component. I have suggested that this backtracking could be licensed by the second component (typically, the head of the compound) selecting for a first component with a particular feature attributed by the compound linking morpheme. The compound linking morpheme must attach at Stratum 2, and compound formation must occur at Stratum 1, under the assumption that morphological operations at Stratum 1 alter properties pertaining to lexical identity, while morphological operations at Stratum 2 assign morphosyntactic features. This assumption also raises a potential explanation for why the second component passes through Stratum 1 independently without any (derivational) morphological trigger: it must be subjected to some change in lexical properties that shift it from a standalone syntactico-semantic entity to one that requires the contribution of the other component.

7 Conclusion

In this paper, I have presented novel data establishing patterns of word stress in Polish that were previously unattested in the literature. Prediction of these patterns requires a greater consideration of faithfulness and exceptionality than is present in Kraska-Szlenk’s (2003) monostratal OT analysis. I have shown that extending the monostratal analysis with a constraint promoting faithfulness to the morphosyntactically unmarked realization of the stem in the input allows many of the novel patterns to be captured. However, the monostratal analysis remains incapable of capturing some patterns of exceptionality and regularization that rely upon distinctions that are outside of its scope, such as derivational versus inflectional morphology and first versus second component of a compound, and struggles to constrain faithfulness-based variation.

Furthermore, I have shown that the rankings of domain-sensitive alignment and faithfulness constraints in the monostratal analysis recapitulate a stratal system, without giving the benefits of subtle differences across strata. I have leveraged this observation to establish a multistratal analysis which is able to successfully predict all established and novel word stress patterns in Polish. While the success of this analysis relies partially upon the introduction of additional theoretical assumptions concerning the treatment of head feet, non-derived words, and compounds, I have argued that these assumptions are fully consistent with the stratal approach and are not arbitrary. As a result, I conclude that the multistratal approach allows for an efficient, comprehensive analysis of word stress in Polish.

References


Appendix A: Orthography-Phonology mappings

Polish orthography is readily mappable to phonemic representations. Graphemes can be mapped to phonemes straightforwardly as follows (mappings which might be contrary to the expectations of the English speaker are highlighted with arrows):

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<th>Phoneme</th>
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