1 Introduction

If you’ve ever studied Shakespeare, you know that Shakespeare uses iambic pentameter. Generally, it alternates weak and strong beats, creating a rhythm that sounds like duh-DUH-duh-DUH-duh-DUH-duh-DUH-duh-DUH. This feels natural, because it mimics the way English tends to sound. But this isn’t a language universal. There are other languages that have different stress patterns. Some languages don’t even use stress at all. Some have stress in a fixed position in a word. And some languages have stress that occurs every third syllable, rather than in alternating syllables.

Ternary rhythm is a rare phenomenon, occurring in maybe five or six languages that we know of (Houghton 2008). If this is so rare, how do we explain it linguistically? Are our current theories and ways of doing phonology adequate to explain it?

In this thesis, I will look at a relatively rare phenomenon (iterative ternary stress) and the ways it is modeled in Optimality Theory. I will begin by presenting the phenomenon and the theory I am using. Next, I will look at different ways that this phenomenon has been modeled. I will then suggest a way that it could modeled, that is not currently used (ternary feet). Finally, I will examine the history of ternary feet in phonology, and why they are not commonly used anymore. Throughout, I will make the argument that ternary feet are a viable alternative to other models and should be considered as a serious possibility.
1.1 Background

1.1.1 Optimality Theory

Optimality Theory (Prince & Smolensky 1993), also known as OT, is a theory of phonology based on constraints that are evaluated in parallel. The central conceit of the theory is that for a given underlying form, many possible outputs are considered according to several ranked constraints. The most optimal candidate becomes the spoken form of the word.

OT features three main components: GEN, CON, and EVAL. GEN generates candidates for the output, CON contains the constraints that are used in considering candidates, and EVAL does the actual process of evaluating candidates according to the constraints. Another important element of Optimality Theory is richness of the base (Prince and Smolensky 1993), or the idea that every language should be able to consider every possible input. For example, English, even though it does not have pharyngeals, should be able to come up with an acceptable output for an underlying pharyngeal.

1.1.2 Ternary Stress

With respect to prosody, it is often thought that there are two types of languages—stress languages and tonal languages, with the possible addition of pitch-accent languages. (For more information on this, see Hyman 2006). In this thesis, I will focus on stress languages. In particular, I will focus on languages with fixed stress, where the stress always lies on the same syllable(s), rather than lexical stress, where stress can lie on any syllable or a subset of syllables, and it can change the meaning of the word.

Many languages that have fixed stress have binary stress, or stress on alternating syllables (Houghton 2008), although this stress pattern may not be entirely iterative. For example, a word containing five syllables may have stress on only the first and third syllables, because the final syllable is extrametrical, a concept which will be discussed in more detail later. However, a select few languages seem to have iterative ternary stress, or stress that falls on every third syllable throughout the word.

One language with binary stress, Pintupi, might be analyzed as follows (Elenbaas and Kager 1999), where FTBIN assesses a violation for every nonbinary foot, PARSESYLL assesses a violation
for every unparsed syllable, and the alignment constraints assess a violation for every intervening syllable between the prosodic constituent and the edge of the next highest prosodic constituent, where a prosodic constituent is a piece of a word that can be grouped together, like a syllable or a foot. This example uses gradient constraints, but the same candidate would win if it used categorical constraints.

As can be seen, a high-ranked FTBIN ensures that all feet contain exactly two syllables, and a just-barely-lower-ranked PARSESYLL ensures that the optimal candidate will have the minimum number of unparsed syllables (one for odd-syllable words, and none for even-syllable words). The ranking of alignment constraints determines where stress will lie, and which syllable, if any, will go unfooted. The candidate with the unfooted syllable lying in the middle is harmonically bounded by candidates a and c, and so will not occur. This is relatively simple, but poses problems when considering languages with ternary rhythm.

How can linguists create an explanation of why stress will occur less often then every two syllables, if FTBIN is a constraint, and feet are often assumed to have to be binary (an assumption that will be discussed later on)? The answer, of course, is that higher-ranked constraints must require this ternary rhythm in order to be satisfied.

In this thesis, I will be looking at two languages- Cayuava and Chugach Alutiq, which have both been claimed to have ternary stress. Chugach’s stress pattern is more complicated than
simple iterative ternary stress, however, the stress pattern is entirely ternary in words containing only light syllables. Cayuvava has regular stress on the antepenultimate syllable, and every third syllable preceding it.

Much of the following discussion will hinge on the definition of a foot. For the purposes of this thesis, a foot will be defined as a metrical unit containing one or more syllables, exactly one of which is stressed. I will also be assuming that all lexical words in stress languages must contain at least one foot.

2 Data

The data for Chugach Alutiiq is as follows, with fortis consonants in bold:

(2) Chugach Data ¹
   a. atáka ‘my father’ (a.tá.ka)
   b. akútamék ‘kind of food (abl sg)’ (a.kú).(t.a.mék)
   c. atúqunikí ‘if he (refl) uses them’ (a.tú.qu).(ní.kí)
   d. pisúquitaqúini ‘if he (refl) is going to hunt’ (pi.sú.qu).(ta.qu.ní)
   e. mapársuqútáqúní ‘if he (refl) is going to hunt porpoise’ (ma.pá.rsu.).(qu.ta).(qu.ní)

Chugach stress falls on the second syllable, and every third syllable after that (3n+2). If the total number of syllables is 3n+1, stress falls on the last syllable, causing the last two feet to be binary iambs.

Between this pattern and the pattern of fortis consonants, which are assumed to be the first phoneme of their respective feet, and it is assumed that feet beginning with a vowel do not contain a fortis consonant, my proposed footing in the right hand column above makes sense.

(3) Cayuvava Data ²

¹Data reproduced from Martínez-Paricio (2012)
²The first seven examples are copied from Elenbaas and Kager (1999), the last two were found in Key (1974), which is a transcription of Cayuvava texts and does not contain translations.
a. dápa ‘canoe’ (dá.pa)
b. tómoho ‘small water container’ (tó.mo).ho
c. arípоро ‘he already turned around’ (a.fí.po).ro
d. arípírito ‘already planted’ (a.ri.pí.ri).to
e. áriihibee ‘I have already put the top on’ (á.ri).(hi.hf.be).e
f. mařahaháeiki ‘their blankets’ (ma.rá.ha).(ha.é.i).ki
g. ikitáparérípeha ‘the water is clean’ (i.ki.tá.pa).(rel.re.pe).ha
h. džitirábaratfokáadi (dží.ti).(ra.bé.ra).(tfo.ká.a).di
i. atúrikoárerezuätfe (a.tí.ri).(ko.ár.e).(rae.á.e)tf e

In Cayuvava, stress always falls on the antepenultimate syllable, and every third syllable in the
leftwards direction after that. Notably, in a word containing five syllables, this means that there
is only one stressed syllable. My proposed footing involves trochees (binary feet with stress on the
first syllable) and amphibrachs (ternary feet with stress on the middle syllable), as well as always
leaving the final syllable unparsed.

For Cayuvava, there is no listed phonotactic evidence for where feet boundaries may be in the
sources that I am working from, so I am basing my foot placement strictly around stress. Following
the lead of Rice (2007), I am using only amphibrachs.

Although both languages seem to have generally ternary stress, the patterns involved are dif­
erent. In Chugach, stress begins at the left edge and moves rightward, while in Cayuvava, stress
begins at the right edge and moves leftward. Chugach also stresses more syllables (two syllables in a
four- or five-syllable word), while Cayuvava only stresses one syllable in the same words. Under my
proposed footing, Chugach uses complete footing, while sometimes Cayuvava leaves syllables un­
parsed, based on other demands of the grammar. However, both languages are able to be analyzed
using ternary feet.
3 Previous Analyses of Ternary Stress

In most OT analyses of stress, all syllables (or all syllables except for one in an odd-syllable word) are parsed into the maximum possible number of binary or two-syllable feet in order to satisfy PARSESYLL, which assesses a violation for each unparsed syllable, and FTBIN, which assesses a violation for each non-binary foot. In order to account for languages with alternative stress patterns, such as ternary stress, there must either be unparsed syllables or feet that are longer than binary.

Various techniques have been proposed in order to deal with ternary stress in phonology. These include ternary feet, superfeet, and LAPSE. I will go into each of these proposals in more detail, using the structural framework of Optimality Theory. I will be ignoring faithfulness constraints as well as markedness constraints referring to the segments that are produced, and focus solely on constraints that address stress and parsing of syllables.

3.1 *LAPSE

One suggestion for how to deal with ternary stress is through the interaction between alignment constraints and *LAPSE (Elenbaas and Kager 1999). *LAPSE is a constraint against multiple adjacent unstressed syllables, which has been found useful in analyses of phenomena other than ternary stress.

This system also uses alignment constraints such as ALLFTL, which assesses a violation for every syllable that comes between a foot and the left edge of the word, as well as PARSESYLL, which assesses a violation for each syllable that is not parsed into a foot. In order to demonstrate how this model would work, I will present an example tableau from Cayuvava, a Brazilian language with ternary stress, copied from Elenbaas and Kager (1999).

They define their constraints as follows (Elenbaas and Kager 1999):

PARSESYLL: All syllables must be parsed by feet.

ALLFTL: Align (Ft-L, PrWd-L), or "The left edge of every foot coincides with the left edge of some PrWd.

*LAPSE: Every weak beat must be adjacent to a strong beat or the word edge.

Under their definition, ALLFTL is evaluated as a gradient constraint, where each foot not at the
left edge of the word can incur multiple violations.

All candidates with three consecutive unstressed syllables are eliminated by the highest-ranked constraint. Then, candidate g is eliminated by ALLFTL due to having more feet, while candidate f is eliminated for having its feet further from the left edge of the word, leaving only candidate d. Note that although Elenbaas and Kager use a gradient version of alignment constraints, candidate d would still be optimal with a categorical version of the constraint.

On the whole, this system seems to work rather well. However, the way that the authors make *LAPSE work this way is by saying that in “some languages” it is violated by sequences of two unstressed syllables, and in other languages (namely, those with ternary stress), it is violated by sequences of three unstressed syllables. One tenet of OT is that, if at all possible, we should avoid using language-specific constraints, so it is for this reason that another analysis would be preferable.

It is important to note that updated versions of *LAPSE use more lapse constraints, and a more specific definition of *LAPSE. Under the newer definition, which I use in my analysis, it is not language-specific. However, it still doesn’t properly address why unparsed syllables are preferable to ternary feet. For more information on this, see Kager (2001).
3.2 Superfeet

One method that has been suggested to parse three syllables into a binary foot, while not allowing ternary feet or unparsed syllables, is the recursive foot, also known as a superfoot, demonstrated below (Martínez-Paricio 2012).

(5) PrWd

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(6)

Feet containing three syllables are parsed as a binary foot, with one of the constituents really being a smaller foot instead of a syllable. In the example above, the five syllable word is considered two binary feet, although the first element of the first foot is a foot on its own. This system still uses the previously mentioned *LAPSE constraint, but ranks it highly so that it is not violated by winning candidates. The directionality of the ternary foot is determined by the alignment constraints. In a footnote, even-parity words that are parsed into three rather than two syllable feet are explained through a highly ranked alignment constraint, similar to the method above, and my method that I will use later on.

Although this system again is said to work to fully explain all ternary or mixed stress systems,
recursive feet do not seem independently motivated, as most of the problems they solve (vowel lengthening, for one) in non-ternary-stress languages, like English, could be equally addressed by simply having unparsed syllables. Additionally, the claim has been made that since syntax prefers binary branching, feet should do the same thing (Martínez-Paricio 2012). However, if it’s true that phonology is binary branching like syntax, we would expect to see binary branching at the prosodic word level. Instead, we see six-syllable words that branch equally into three separate feet, such as in the English onomatopoeia (σσ)(σσ)(σσ). Here, the feet aren’t arranged binarily— they all seem to branch equally from the prosodic word. A theory could be imagined in which two of the feet are chosen to be one larger prosodic word or one larger foot, however, there doesn’t seem to be any actual phonetic evidence for this.

\[
\text{(7) Prosodic Word} \quad \begin{array}{c}
\ \ \ \ \ \ \ \ \ \\
(\sigma\sigma) & (\sigma\sigma) & (\sigma\sigma)
\end{array}
\]

It also raises the question of how far this recursion goes. Can syllables be recursive? Can phonemes? What would it mean for a syllable or a phoneme to be recursive? This isn’t necessarily a damning argument against them, but it is something that should be considered by proponents of the recursive foot theory.

It’s also worth considering whether or not phonology and syntax follow the same patterns. Just because we see evidence for binary branching in syntax, does this necessarily imply that phonology also must branch binarily?

### 3.3 The roles of Gen and Con in modeling ternary rhythm

Rice (2007) presents a theoretical question—what are the limits of Gen? Is it possible to say that Gen will only generate binary feet? The paper does not reach a satisfying conclusion, but it does take a good look at different models for ternary rhythm.

Ultimately, Rice rejects ternary feet because they are typologically rare and because they would require ternarity-specific measures. He also says that he finds it impossible to create satisfying ways to produce ternary feet using current OT mechanisms. I disagree with this latter point— I believe that the constraints I use are satisfying. With regards to the former point, it is true that situations
calling for ternary feet are rare, but ternary stress is a rare phenomenon that does exist. I would much rather use a theory that has a few flaws, instead of one that doesn’t explain (and gives up on explaining) a phenomenon that occurs, simply because it is rare.

The main argument against ternary feet seems to be that they are complicated to deal with under current perceptions of parallel OT (other versions of OT not being considered in any analyses I have read of ternary stress), which I don’t see as a sufficient reason to dismiss them altogether. Although Rice offers some interesting questions, he doesn’t (at least within the published paper) present any actual analyses or tableaux experimenting with ternary feet.

4 Ternary Feet

Somewhat surprisingly, although there have been various arguments on ways to deal with ternary stress without ternary feet, very few of these arguments (with the exception of Rice (2007)) even address the possible existence of ternary feet. Instead, they simply assume that when FTBIN is violated, it is always violated by degenerate feet, which contain only one syllable. These analyses view ternary feet as typologically impossible. There are some analyses of languages such as Cayu­vava that use ternary feet, such as Levin (1988) and Halle and Vergnaud (1987). Their analyses, however, are both from before Optimality Theory was formulated.

For the rest of this thesis, I will divide FTBIN into two separate constraints. I assume that different rankings may apply in different languages, but they share the principle of ternary stress being caused by a lower-ranking *3 (defined below). Some of the constraints I am using have been drawn from various sources, and some, such as PNonFin, or *Lapse are from sets of constraints where the other constraints do not seem to play a significant role in the languages I am looking at.

\( (8) \) *3 assesses a violation for each foot containing exactly three or more syllables in the output.

*1 assesses a violation for each foot containing exactly one syllable in the output.

PARSESYLL assesses a violation for each unparsed syllable in the output.

ALLXY assesses a violation for each intervening syllable between the Y edge of prosodic unit X and the Y edge of the word.

BOUNDED\(^3\) assesses a violation for each weak syllable within a foot that is not adjacent to

\(^3\text{from Buckley 2009}\)
the foot edge.

*LAPSE$^4$ assesses a violation for every sequence of two adjacent weak beats.

*LONGLAPSE assesses a violation for every sequence of three adjacent weak beats.

$\text{FNONFIN}^5(\sigma)$ assesses a violation for every syllable that is parsed into a foot.$^6$

5 Chugach

Chugach Alutiiq is an Eskimo-Aleut language spoken in Alaska. Although there are less than 500 speakers remaining today, there is an active language revitalization movement. Chugach is an agglutinative language, resulting in long words in which it is easy to see the stress pattern. In words that contain only light syllables, Chugach has a regular ternary stress pattern. In Chugach, which has syllable structure (C)(C)(C)V(V)(C), light syllables are defined as those containing only one vowel. (Leer 1985)

5.1 Chugach Phonotactic Details

In Chugach Alutiiq, there is phonetic evidence that feet exist. If a foot begins with a consonant, that consonant is realized fortis. Note that in some languages, consonants in stressed syllables may be fortis; however, in Chugach the first syllable of a foot is never stressed. Therefore, I am following the general foot structure of previous analyses, except with ternary feet. In previous analyses, most binary feet are followed by an unfooted syllable. Instead, I join that unfooted syllable to the previous foot in order to use ternary feet. This will leave the leftmost syllable of each foot in the same place—the place indicated by phonetics. The data I am working from does not distinguish primary from secondary stress.

5.2 Chugach analysis

According to this analysis, all feet in Chugach are either amphibrachs (a trisyllabic foot with stress on the middle syllable) or iambs (a binary foot with stress on the second syllable). Iambs can easily be preferred using ALLHEADSRIGHT or ALIGNL(HEAD, FOOT) (which is a categorical

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$^4$Both *Lapse constraints are from Kager 2001

$^5$from Hyde (2003)

$^6$I will only be using this constraint in the analysis of Cayuvava.
constraint). For my analysis I will be using \textsc{AllHeadsRight}, which assesses a violation for each syllable between the head of a foot and the right edge of that foot, because I already use \textsc{AllFtr}, and it makes the most sense to use parallel constraints.

Unfortunately, current posited OT constraints do not provide a nice way for a language to prefer amphibrachs, which are harmonically bounded under both types of alignment constraints. Rice (2007) suggests using a constraint R\textsc{H}Type=\textsc{A}, which would simply assess a violation for each syllable that is not an amphibrach. This is modeled after the constraints R\textsc{H}Type=\textsc{I/T}, constraints from the original Prince & Smolensky (1993) proposal, where the constraint would assess a violation for each syllable that was not the given type (either iamb or trochee).

Buckley (2009) presents an alternative: \textsc{Bounded}, which assesses a violation for every weak syllable within a foot that is not adjacent to the foot edge. This has the double benefit of constraining the typology to feet with a maximum of three syllables (since we are working on the assumption that feet cannot contain two stressed syllables, in a foot containing four or more syllables, at least one weak syllable would not be adjacent to the foot edge), as well as constraining ternary feet to amphibrachs.

My constraint ranking is as follows, demonstrated below in tableaux:

\begin{verbatim}
*1, \textsc{Bounded}, *\textsc{LongLapse}, \textsc{Parse} \ll \textsc{AllFtr} \ll \textsc{AllHr}, \textsc{AllFtL} \ll \textsc{AllHl} \ll *3, *\textsc{Lapse}
\end{verbatim}

\begin{table}
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\begin{tabular}{|c|c|c|c|c|c|c|c|}
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a. & (a.ta.ka) & *! & & & & ** & * & * & & \\
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b. & (a.ta.ka) & & & & & & * & * & * & \\
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c. & (a.ta).ka & & & *! & & * & & & & \\
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d. & (a).(ta.ka) & *! & & & ** & * & & & & \\
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<th>PARSE</th>
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The top four constraints, which are unviolated by all winning candidates, ensure complete parsing of syllables in either two-syllable feet or amphibrachs. A foot containing four syllables cannot exist in Chugach, because it will violate BOUNDED at least once, no matter which syllable is stressed. The data that I am working from does not say whether or not one-syllable words exist in Chugach.

Because of this parsing, with only binary and ternary feet, the winning candidate for three-syllable words will be a single amphibrach. Four-syllable words will be parsed into two binary feet. Because ALLHR is ranked above ALLHL these feet (and all binary feet) are iambs. In the five-syllable word, the amphibrach comes before the iamb because ALLFTR is ranked above ALLFTL. Likewise, in the seven-syllable word, the first foot is the ternary one.

Based on the previously mentioned possible footings, either two amphibrachs or three iambs seem possible for the six-syllable word. However, because ALLFTR is ranked above both *3 and LAPSE, the language will prefer fewer ternary feet to more binary feet, and so candidate a wins.

### 5.3 Chugach Summary

I have shown that with a few modifications, it is entirely possible to model ternary rhythm with ternary feet. The only modifications I have made to previous theories is separating the constraint against unary feet from the constraint against ternary feet, and a constraint preferring amphibrachs. Neither of these are major changes, and the only constraint really approaching a ternary-specific mechanism BOUNDED which, I argue, is rather a preference for viable feet that happens to only be relevant for ternary stress.
Because it seems relatively simple, one must wonder, why do people so seldom consider ternary feet?

6 Cayuvava

Cayuvava was a Brazilian language. It is no longer spoken, but its phonology and morphology were documented by Harold Key, as well as examples of Cayuvava stories. Unfortunately, there are no audio recordings. As of the 1960s when Key was working, there were six remaining native speakers of the language, who were all elderly, and the language had not been transmitted to their children or grandchildren, who all spoke Portuguese. Cayuvava is thought to be a language isolate (Key 1974).

6.1 Cayuvava Analysis

My constraint ranking for Cayuvava is as follows:

BOUNDED, FNonFin << *L << *LongLapse << AllFtL << AllHL, AllFtR << AllHR << Parse, *3, *Lapse

FNonFin, which was defined above, creates the pattern seen in my analysis where the final syllable is never parsed. According to Key (1974), there are no one-syllable words in Cayuvava, which makes sense if all words must have at least one stressed syllable (which must be parsed into a foot) and the final syllable of a word is not parsed.

(14)
### (15)

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Unlike in Chugach, in Cayuvava, PARSE is not highly ranked. This means that, often, it will be easier for the language to leave unparsed syllables than binary feet. Like Chugach, BOUNDED is very highly ranked, ensuring that there will be no feet containing more than three syllables, and that all ternary feet will be amphibrachs.

In the case of a two syllable word, as discussed above, because FNonFIN is so highly ranked, only the first syllable will be parsed into a foot. Likewise, in a three syllable word, only the first two are parsed into a binary foot. This is a trochee (as are all the binary feet in the language), because ALLHL is ranked above ALLHR.

When possible, Cayuvava uses ternary feet rather than a binary foot and an unparsed syllable (for four- and seven- syllable words), due to the ranking of ALLFTL above *3.

Interestingly, in five-syllable words, Cayuvava leaves two unparsed syllables rather than foot them into a binary foot. This is due to a highly ranked ALLFTL and FNonFIN, which are ranked above *3, *LAPSE, and PARSE.

When there is one binary foot and one ternary foot, as in six-syllable words, again because of
the high ranking of ALLFTL, the binary foot will be to the left of the ternary foot.

It may seem that, because of a low-ranked PARSE, it would be preferable to only have one foot to the far left of the word. However, as in candidate e of example 20, this would create long lapses, which are disfavored in comparison to the optimal candidate based strictly on ALLFTL.

6.2 Comparison between Chugach and Cayuvava

Although the two languages I have looked at have different footing patterns, the tableaux that correctly generate the output share a few common features. For one thing, BOUNDED and *LONGLAPSE are unviolated by all winning candidates and so are ranked very highly. For another, ALLFTX is ranked above all three of *LAPSE, ALLHX, and *3, which is what creates a pattern where ternary feet are optimal.

There are two main differences between their constraint rankings. First of all, in Chugach, ALLXR is ranked more highly, while in Cayuvava, it's ALLXL. This is why the patterns seem almost to mirror each other. More significantly, PARSE is ranked much lower in Cayuvava than in Chugach. This causes unparsed syllables to be present on both ends of the word in Cayuvava, while they seem not to exist in Chugach.

7 Theoretical Implications

So, then, if it is entirely possible to create a satisfactory analysis of ternary rhythm using ternary feet, why do linguists these days so seldom consider ternary feet as an option? The literature is somewhat lacking—some sources say that they do not want to look at ternary feet because they are a “ternarity-inducing mechanism” (Elenbaas and Kager 1999), some merely say that they don’t want to “resort” to ternary feet, and some do not mention them as an option at all. Some sources (Houghton (2008) for example) mention the ternary foot as something that has previously been considered, but offer no reasons for rejecting it.

First: to discuss the claim of ternary feet as a ternarity-specific mechanism. I contest that claiming this is similar to claiming that something like allowing codas is a coda-specific mechanism. Allowing ternary feet is not like adding in an entirely new mechanism, it is merely expanding the range of what feet can already do. There are analyses that use unary feet, so how are ternary feet
I have also considered other possible claims against ternary feet. One could say, for example, that they are unnecessary, or that they are too complicated computationally, or that other linguists haven't looked at them, so why should we?

I believe that with my analyses, I have shown that ternary feet are not, in fact, too complicated computationally. It may take time to come up with a satisfactory constraint ranking, but that's true for any analysis. I have not seen any linguists suggest that ternary feet would be too complicated for the brain to handle; instead they suggest that because they can't find solutions, solutions are unlikely to be found.

This isn't to say that ternary feet are necessarily the “correct” solution. Another theory, like the *Lapse theory or the Superfeet theory, may prove to be better. But as ternary feet do seem to work with only slight adjustments to our theory, they ought to be considered somewhat more than they currently are, which is to say never. When all these theories, which work for at least one language, are attempted for the other languages using ternary stress, such as Tripura Bangla (Houghton 2008) it may be possible to tell which continue to succeed.

Overall, the *Lapse theory is relatively similar to that which uses ternary feet. Indeed, they may just be two different ways to solve the same problem. The Superfeet theory, which requires adding in a new element to the prosodic hierarchy, has greater consequences, and should most likely not be used unless it is shown that it significantly contributes to our understanding of prosody.

Then, as to the idea that ternary feet are unnecessary: it is true that there are satisfactory analyses that do not include ternary feet, but it is sometimes possible, depending on the constraints used, to come up with multiple satisfactory analyses of complicated problems. That's not to say that all reasonable analyses shouldn't be considered. One may argue that the simplest solution is to not use ternary feet, and that therefore another explication should be chosen. I would respond, however, that they are actually a simpler solution than creating a system where there is exactly one unparsed syllable between feet, or one where feet can be recursive.

Hyde (2011) claims that if extrametricality is considered, the need for ternary feet is eliminated—however, he is only considering in his chapter languages that have a ternary stress pattern on either edge of the word, such as Latin, with the specific case of analyses where the word-final foot is ternary. In these languages, it may be most appropriate and systematic to consider the final
syllable extrametrical (indeed, as I do with Cayuvava) rather than call the final foot a ternary foot. However, extrametricality on its own does not explain the iterative ternary stress patterns found in such languages as Chugach or Cayuvava. Most likely, Hyde was unaware of the stress patterns found in these languages, or was not considering them when he made his claim.

Finally, the idea that other linguists aren’t using ternary feet, so why should we, is an interesting one. Although I have been unable to find much usage at all of ternary feet in Optimality Theory (cf. Rice (2007)), they have been used in several analyses in earlier metrical phonology, as will be discussed below.

However, even if ternary feet had not been previously used, it should be fairly evident that this hypothetical argument against them is flawed and, in fact, stands in the way of the progression of our understanding of human language.

7.1 History of Ternary Feet

As has been mentioned above, mention of ternary feet is (relatively) common in pre-Optimality Theory literature, particularly that published in the 1980s. For example, Nespor and Vogel (1986) define a foot as the constituent above the syllable in the prosodic hierarchy, and they say it contains “one or more syllables”. Later, they go on to say that, in practice, the only feet that exist are binary feet, degenerate/unary feet, and, in rare cases, ternary feet.

This, of course, means that in earlier phonological theories ternary feet were assumed to exist, even if they were rare. There was not a strict definition of feet as either binary or degenerate. Interestingly, this definition also includes the possibility of feet containing more than three syllables, although this is never seen (and their later comments make it clear that this doesn’t actually exist).

So why are ternary feet no longer used? There are, of course, some theories that are later discovered to be incorrect. Usually, however, in that case, there will be some literature from the time explaining this shift in theory or arguing against the theory. However, I have been able to find none of that.

Beginning around the 1990s, papers that mention ternary feet deny their existence as a foregone conclusion. Admittedly, ternary stress is rather uncommon, so it makes sense that it wouldn’t be mentioned very often. But it is rather interesting that is no gradual shift or mention of why ternary feet are thought to be invalid. So why did this change occur?
Judging by the times at which these various papers were written, and the fact that most of the pro-ternary feet papers are strictly descriptive with no mention of rules or processes, while the anti-ternary feet papers tend to be using Optimality Theory, my hypothesis is that as OT became more prevalent as a theory, with its more stringent and mathematical methodology than theories that simply described stress placement instead of demanding a reason why stress is assigned the way it is, phonologists looking at languages with some sort of ternary stress began looking much more at ways in which to draw common ground between languages rather than find the simplest solution to describe the process of each language.

This isn’t in and of itself a bad thing—if one believes in Universal Grammar, then all (or at least the majority of) grammatical processes are thought to come from some grammar function in humans. So it makes sense that a theory of Universal Grammar would look at commonalities between languages. However, this does run the risk of ignoring or overlooking features of individual languages in an effort to make them fit a theory.

One common theme between the previous mentions of ternary feet is that they do not seek to explain where ternary feet come from, they simply describe them as existing. There are older analyses of English that use ternary stress in words such as *a.bra.ca.dá.bra* in order to ensure that all syllables are footed, which is something that OT analyses of English never do.

(23) \[ \text{abracadabra} \]

\[ \text{a} \quad \text{bra} \quad \text{ca} \quad \text{da} \quad \text{bra} \]

In Optimality Theory, there is a much higher pressure for an analysis to explain phenomena through constraints shared by all languages. This pressure, while it supports the idea of a Universal Grammar, sometimes results in linguists having to find a complex solution for something that might be able to be solved relatively simplistically with more language-specific rules.

It’s untrue that all linguistic phenomena can be described through a universal process. Some processes seem to be language- or language family-specific. Knowing this, an overrigorous attempt to explain every phenomena through a strictly universal lens will create faulty conclusions about how language works generally. Just because something occurs in one language, doesn’t mean that it occurs in every language.
When the predominant theories of phonology were rule-based, rules didn’t tend to be applied with quite the same level of universality. Flapping, for example, exists in English, but it wasn’t assumed that intervocalic flapping is a rule of every language or stored in the language-mechanism. This sort of allowance for language-specific rules most likely created an environment where positing ternary feet in specific cases but not as a possible feature of every language didn’t seem contradictory. In Optimality Theory, however, with such a weighty dependence on the universality of constraints and features, and the much higher demand for things to be explained through a specific process that is universal, ternary feet, which violate the standard constraint FTBIN, were thought not to exist because it’s easier for linguists that way.

There are also linguistic phenomena that cannot be explained through parallel versions of Optimality Theory, such as opacity. This is not to say that Optimality Theory doesn’t provide good explanations for a variety of phenomena, but it’s certainly possible that some things, like opacity, and maybe like ternary stress, require an adjustment of the existing theory.

If ternary feet do exist, what effects does that have on the broader implications and typology? Why don’t we see ternary feet more often? I’m not sure. Based on the factorial typology, we would expect a small number of languages— but more than 5 out of over 7000— to have ternary feet. But this same problem exists for the *Lapse theory or the recursive feet theory. All of these theories only truly deal about five constraints that effect ternarity. Even if only one order created ternary rhythm—which isn’t true; under my analysis either ALLFTL or ALLFTR ranked above *3, *LAPSE ALLHL, and ALLHR will cause ternarity—we would expect there to be 120 possible rankings of those five constraints, which out of 6000 languages would give us around 60 with ternary rhythm.

Instead, we see only five or six—an order of magnitude lower. Perhaps there’s another factor that isn’t being considered. Perhaps cross-linguistically, ternarity is dispreferred for another reason. If there is something else going on, however, this is something that affects any theory of ternary rhythm, not merely mine.

8 Conclusion

So, what can be drawn from this? Are ternary feet real? Well, I don’t know for sure. What I do know is that they seem to work, and there aren’t major reasons why they shouldn’t be considered.
The next step seems to be trying out ternary feet in the other languages with ternary stress, and perhaps trying out ternary feet within other theories of phonology beyond OT. It would also be worth considering the factorial typology—the predictions that are made for possible languages with these constraints. Are there predicted languages that have patterns that we don’t see here? Do other theories of ternary stress not have these same problems with respect to the factorial typology?

My constraint set suggests that there should be languages in which *3 and BOUNDED are ranked lower than ALLEFTX and PARSE. A language such as this would have only one foot, with only one stressed syllable on the edge of the word. In fact, this seems similar to some languages with fixed stress, such as French, where stress always appears only on the right edge of the word (with a few exceptions for words that end in a schwa). I’m not necessarily suggesting that this is the correct explanation for the pattern found in French, merely that this pattern suggested by the factorial typology doesn’t seem entirely impossible.

I think it is clear, that ternary feet are a distinct possibility. Reasons that people have given against them can also be given against other theories to explain ternary stress, and they have been used historically in linguistics, with no good reason having been given for their lack of continued usage.

In conclusion, ternary feet can be used in Optimality Theory with very minor adjustments that have already been used to solve non-ternary problems (Buckley 2009, Hyde 2003), and they merely require an expansion of the already existing typology of feet, rather than the creation of a new mechanism, such as recursive feet.

For both Cayuava and Chugach Alutiiq, it is entirely possible to create satisfying analyses (which I have done), and it should be reasonably possible to do so for other languages with ternary stress. Ternary feet do not necessitate major changes to phonological theory, and, in fact, the main reason that they are used so relatively infrequently is likely more to do with attitudes of linguists working under Optimality Theory than because of any real truths about the nature of feet.

In conclusion, ternary feet are an entirely viable possibility, with significant advantages over superfeet specifically, and ternary feet ought to be considered significantly more frequently.
References


