A typology of clash-tolerating languages

Coppe van Urk
Generals Paper, MIT

This paper investigates the typology of quantity-insensitive languages that tolerate stress clashes. Two descriptive generalizations emerge from this typology: 1) clashes are preferentially realised away from the edge, and 2) clashes with primary stress are avoided (Kager 2001). I demonstrate that this result cannot be captured in directional theories of stress, such as those employing gradient alignment (e.g. Gordon 2002; Alber 2005) or serial models (Prince 1983), because, in such approaches, the directionality of stress assignment is independent of preferences for clash realization. As a result, the distribution of clashes in quantity-insensitive languages provides an argument for a *non-directional* approach to stress (Kager 2001; McCarthy 2003; Buckley 2009). I propose a modified version of this approach, which avoids some pathological predictions made by the Kager (2001) system. A factorial typology is calculated using this constraint set and shown to be appropriately restrictive.

1 Introduction

A stress clash refers to a *sequence of adjacent stressed syllables*. Clash avoidance, alongside lapse avoidance, is assumed to be one of the driving forces behind the placement of stresses (e.g. Prince 1983), in recent work in particular (Kager 2001, 2005a, 2005b; Gordon 2002; McCarthy 2003; Alber 2005; Buckley 2009).

Some quantity-insensitive languages systematically realize clashes in order to avoid a sequence of unstressed syllables, however, though this is quite rare. This rarity is due to the fact that such systems because it requires stress to be anchored at both edges of the word. To see why, consider a system that never tolerates a lapse and anchors stress just at the left edge.

Table 1: 4 syllables with fixed initial

	Initial	*Lapse	*Clash
☞ 1020			
1022			*!

Table 2: 5 syllables with fixed initial

	Initial	*Lapse	*Clash
☞ 10202			
10220			*!

In these tableaux, we see that, because this hypothetical system has the freedom to do whatever it wants at the right edge, a stress clash is never necessary to avoid a lapse.

As a consequence, consistent tolerance of clashes only arises when a language anchors stress at *both* edges, by always stressing the initial and the final, for example. But when this situation arises, there are a lot of options for clash placement. To see this, consider a language with fixed initial and penultimate stress, like Passamaquoddy (LeSourd 1988, 1993). Passamaquoddy has primary penultimate stress, consistent secondary stress on the initial, and it tolerates a clash to avoid a lapse (1a–f).

(1)	a.	ˈtop.kwan	'dirt, soil'	10
	b.	ˌtop.ˈkwa.namkw	'dirt, soil'	210
	c.	ˌwi.coh.ˈke.mal	'he helps the other'	2010
	d.	ˌwi.ˌcoh.ke.ˈke.mo	'he helps out'	22010
	e.	ˌwi.coh.ˌke.ta.ˈha.mal	'he thinks of helping the other'	202010
	f.	ˌteh.ˌsah.kwa.ˌpa.sol.ˈti.ne	'let's walk around on top'	2202010
		(LeSourd 1988: 140–143)		

Note that Passamaquoddy always realises this clash between the initial and peninitial syllable. A problem that arises, however, is that basic rhythmic constraints do not straightforwardly capture this preference. As Table 3 shows, we need constraints that regulate between the candidates (d), (e), and (f).

Table 3: Passamaquoddy

	Initial	NonFinality	*Lapse	*Clash
a. 2020201		*!		
b. 0202010	*!			
c. 2020100			*!	
d. ? 2202010				*
e. ? 2022010				*
f. ? 2020210				*

There are several ways in which preferences for clash placement can be encoded. One way is to assume that there is a *directional bias* in the process of stress assignment, so that any given language assigns stress either from left-to-right or from right-to-left. This can be enforced by means of gradient alignment constraints (e.g. Gordon 2002; Alber 2005), which pull all stresses as close to one edge as possible, or by adopting a serial model, in which stresses are assigned one at a time. Both of these moves will result in languages that prefer to realize a clash at the left edge and in languages that prefer to realize a clash at the right edge. For example, we can capture the Passamaquoddy pattern by adopting a gradient constraint ALIGN-L, which assigns violations for every syllable intervening between a stress and the left edge. This is illustrated in the tableau below.

Table 4: Passamaquoddy with gradient alignment

		Initial	NonFin	*Lapse	Align-L	*Clash
a.	2020201		*!		************	
b.	0202010	*!			*********	
c.	2020100			*!	******	
d. ☞	2202010				*********	*
e.	2022010				**********!	*
f.	2020210				**********!*	*

Another approach to capturing clash placement preferences is developed by Kager (2001). Kager proposes a pair of clash-licensing constraints, which directly encode preferences for where a clash should be. The first of these, CLASH-AT-EDGE, penalizes every clashes not aligned with the edge of a word. The second, *CLASH-WITH-PEAK, specifically bans a clash with the primary stress.

(2) CLASH-AT-EDGE:
Every clash should be at the edge of a prosodic word.
*CLASH-WITH-PEAK:
Assign a violation mark for a clash with the primary stress.
(Kager 2001:10–11)

Passamaquoddy illustrates the first of these preferences. A clash at the edge is favored over a medial clash. This is also the edge without primary stress, so that the constraints in (2) are not in conflict. We can then apply the constraints in (2) to the Passamaquoddy pattern as in Table 5.

Table 5: Passamaquoddy using clash-licensing (Kager 2001)

		Initial	NonFin	*Lapse	Clash-at-Edge	*Clash-with-Peak
a. ☞	2202010					
b.	2020210				*!	*
c.	2022010				*!	
d.	0202010	*!				

These two models for regulating clash placement make different predictions about the shape of the typology. If a directional model is on the right track, we should find that the placement of clashes is independent of factors such as the position of primary stress. If clash placement is instead regulated by clash-licensing constraints, we should observe a tight correlation between clash placement and the location of primary stress. In this paper, I will argue that this is in fact what we find. In all clash-tolerating languages, clashes are realized at the edge opposite to main stress. The one exception, South Conchucos Quechua (Hintz 2005), arises because of a conflict with the preference to realize the clash at the edge.

As a result, the typology of quantity-insensitive clash-tolerating languages constitutes an argument for Kager's (2001) approach, and, by extension, a categorical approach to stress. In addition, I will show that it presents a problem for any serial model of stress, such as an approach couched in Harmonic Serialism, because this is necessarily capable of imposing a directional bias.

The paper is structured as follows. Section 2 describes the various patterns that make up the typology. In section 3, I will outline why these patterns cannot be captured in directional models. In section 4, I show that Kager's (2001) constraints capture the relevant generalizations, but identify two problems of overgeneration. Section 5 develops a modified constraint set and calculates a factorial typology, using OT Soft (Hayes, Tesar, and Zuraw 2013), that is shown to be adequately restrictive.

2 The typology of quantity-insensitive clash-tolerating languages

The first task I will be concerned with is to detail the various systems that make up the typology of clash tolerance. Since clash tolerance is rare, I will discuss each language in detail and try to be careful about what counts as an "attested" stress pattern (see de Lacy 2003 for a discussion of some of the dangers in constructing a stress typology; *cf.* the uncertainty about the reality of the "initial dactyl" effect in Kager 2001; Alber 2005; Hyde 2008). To achieve this, I adopt two criteria for evaluating whether a language should be admitted to the typology. The first criterion is that the stress pattern *must* have a consistent phonetic or phonotactic correlate. The second criterion relates to cyclicity. Most of the examples relevant to stress typology are not monomorphemic, but contain several affixes, because it is only in long words that the logic of many stress systems is revealed. However, cyclicity effects often emerge under affixation, such as preservation of stem stress. This means that clash tolerance can arise as an effect of cyclicity (see, for example, Pike's 1964 description of Auca stress). The second criterion for treating a stress system as clash-tolerating is then that we can rule out cyclicity effects as the driving force.

2.1 Languages with clashes at the left edge

I will first discuss the four languages in which a clash is realized at the left edge. There are three types of systems in this set. We have already seen one of these, Passamaquoddy. There is also a pattern that is identical to Passamaquoddy, but with final stress. In the third system, a preference for edge clash overrides the desire to avoid peak clashes.

2.1.1 Passamaquoddy

Passamaquoddy is described as clash-tolerating in LeSourd (1988, 1993) and Hagstrom (1997). LeSourd (1988) proposes the following three descriptive rules for this system, an Initial Stress Rule, an Alternating Stress Rule, and a Main Stress Rule:

(3) **Initial Stress Rule:**
Stress the first syllable of a word.
(LeSourd 1988:133)

(4) **Alternating Stress Rule:**
Stress the even-numbered syllables of a word, counting from right to left.
(LeSourd 1988:133)

(5) **Main Stress Rule:**
Put main stress on the penultimate syllable.
(LeSourd 1988:144)

In other words, Passamaquoddy consistently tolerates a clash between secondary stresses on the initial and peninitial in odd-numbered words. Examples are given in (6a–f).

(6)	a.	ˈtop.kwan	'dirt, soil'	10
	b.	ˌtop.ˈkwa.namkw	'dirt, soil'	210
	c.	ˌwi.coh.ˈke.mal	'he helps the other'	2010
	d.	ˌwi.ˌcoh.ke.ˈke.mo	'he helps out'	22010
	e.	ˌwi.coh.ˌke.ta.ˈha.mal	'he thinks of helping the other'	202010
	f.	ˌteh.ˌsah.kwa.ˌpa.sol.ˈti.ne	'let's walk around on top'	2202010
		(LeSourd 1988: 140–143)		

This stress patterns are realised phonetically in terms of pitch (LeSourd 1988). The highest pitch is realised on the rightmost stressed syllable, and the next highest pitch on the initial (LeSourd 1988: 144–145). There is a great deal of data in LeSourd (1988) and this pattern seems consistent across the language. In addition, it interacts in complex, but predictable, ways with a system of syncope (LeSourd 1988, 1993).

As LeSourd (1988) points out, no cyclicity effects are evident in this system. Main stress shifts under affixation and always resides on the penultimate syllable (7a–b).

(7) a. ˈtop.kwan
dirt
'dirt, soil'

b. ˌtop.ˈkwan-amkw
dirt-particulate
'dirt, soil'
(LeSourd 1988:141)

Similarly, stress on the initial syllable of the stem is not preserved under prefixation and shifts to the initial syllable of the prefix (8a–c).

(8) a. ˌl-e.ˈwe.sto
thus-speak.3
'He speaks'

b. ˌwi.k-e.ˈwe.sto
like-speak.3
'he likes to talk'

c. ˌseh.ˌta.y-eˈwes.to
backwards-speak.3
'he speaks while walking backwards'
(LeSourd 1988:141)

Another well-documented language with this pattern is Émérillon, whose stress system is described by Gordon and Rose (2006). When the final syllable is open, Émérillon has the same stress pattern as Passamaquoddy, with a consistent clash between the initial and the peninitial syllable in words with an odd number of syllables and primary stress on the penultimate syllable (9a–d). Note, however, that this clash-tolerating pattern is optional in production, and alternates with a pattern without consistent stress on the initial syllable.

(9)	a.	ˌta.ˈwa.to	'eagle'	210
	b.	ˌma.na.ˈni.to	'how'	2010
	c.	ˌpa.ˌku.ʔa.ˈsi.ri	'small yellow banana'	22010
	d.	ˌde.ze.ˌka.si.ˈwa.ha	'your tattoo'	202010

(Gordon and Rose 2006: 6–7)

Placement of primary stress in Émerillon is also sensitive to weight, so that it really exhibits two clash-tolerating patterns. Specifically, the final syllable carries primary stress when closed, resulting in a clash in words with an even number of syllables (10a–d).

(10)	a.	ˌmo.ˈkoɲ	'two'	21
	b.	ˌe.re.ˈzor	'you come'	201
	c.	ˌza.ˌwa.pɨ.ˈtaŋ	'puma'	2201
	d.	ˌke.dʒu.ˌka.si.ˈwar	'apron'	20201
		(Gordon and Rose 2006: 6–7)		

Gordon and Rose show, using acoustic measurements, that this stress system is encoded in different ways by Émerillon speakers. Speakers use duration, intensity as well as fundamental frequency to differentiate primary stress, secondary stress, and the absence of stress. Gordon and Rose do not report effects of cyclicity, but also do not provide data that allows us to conclusively rule out such effects. However, the stress system outlined above does seem to interact consistently with lexically stressed affixes, suggesting that cyclicity effects are not at play (Gordon and Rose 2006:11).

To sum up, a system with a consistent clash between secondary stresses on the initial and peninitial in words with an odd number of syllables seems robustly attested, both in Passamaquoddy and Émerillon. The same system has been claimed to obtain in Biangai (Kager 2001; Gordon 2002). However, the original source does not unambiguously indicate a clash-tolerating system (Dubert and Dubert 1973).

2.1.2 Tauya

Tauya is a Papuan language documented by MacDonald (1990). MacDonald offers the following description of Tauya stress:

"*Primary stress falls on the final syllable in a word, with secondary stress on preceding alternate syllables. The initial syllable in a word is never without stress; if a word is polysyllabic, the initial syllable always receives secondary stress, even if this results in adjacent stressed syllables.*" (MacDonald 1990: 84)

Tauya then appears to be a clash-tolerating language, in which the clash systematically arises between the initial and peninitial syllable of even-numbered words. This can be illustrated with the examples in (11a–d).

(11)	a.	ˌno.ˈno	'child'	21
	b.	ˌʔu.nu.ˈta	'mat'	201
	c.	ˌmo.ˌmu.ne.ˈpa	'sit (same subject)'	2201
	d.	ˌya.po.ˌti.ya.ˈfo	'my hand'	20201
		(MacDonald 1990: 52–53)		

Although MacDonald notes that this description is "very tentative" (MacDonald 1990: 80), there is a phonotactic correlate of this pattern. MacDonald observes that unstressed syllables may optionally reduce to a schwa. This leads to the alternations in (12a–d), which corroborate MacDonald's description of the stress system.

(12)	a.	ˌno.ˈno vs. *nə.no	'child'	21
	b.	ˌʔu.nu.ˈta vs. ʔu.nə.ta	'mat'	201
	c.	ˌmo.ˌmu.ne.ˈpa vs. mo.mu.nə.pa	'sit (same subject)'	2201
	d.	ˌya.po.ˌti.ya.ˈfo vs. ya.pə.ti.yə.fo	'my hand'	20201
		(MacDonald 1990: 52–53)		

Since little more than this is offered in MacDonald's description, we might be skeptical about treating this as an attested stress pattern, also because Tauya is the only system to my knowledge that has been claimed to (consistently) be of this type.

However, we have seen the same system in Émérillon words with a final closed syllable. In addition, we will see that all of the properties that combine to create this stress pattern are independently attested in systems that have been investigated in more detail. On these grounds, I will treat this as a real pattern.

2.1.3 South Conchucos Quechua

The majority of languages that have a clash tolerate a clash only between two secondary stresses. There is a pattern, however, in which the preference for edge clash overrides the dispreference for clashes with the peak systematically. The one attested example of this is South Conchucos Quechua (Hintz 2006), though, fortunately, its stress system has been examined in detail.

The basic stress pattern is given in (13a–g). Primary stress is on the initial syllable and secondary stress alternates leftward from the penult. A clash is systematically tolerated between the primary stress and the peninitial syllable in odd-numbered words.

(13)	a.	ˈshu.maq	'pretty'	10
	b.	ˈpi.ˌta.pis	'anybody'	120
	c.	ˈi.ma.ˌku.na	'things'	1020
	d.	ˈtu.ˌshu.ku.ˌna.qa	'dancers'	12020
	e.	ˈchu.pan.ˌki.man.ˌlla.chi		
		'you would likely have just gotten drunk'		102020
	f.	ˈwa.ˌra:.ka.ˌmu.nqa.ˌna.chi		
		'hopefully it will appear at dawn'		1202020
	g.	ˈcha.krant.ˌsik.ku.ˌna.ta.ˌra:.chir		
		'our fields supposedly still'		10202020
		(Hintz 2006: 487–488)		

The stress pattern in (13a–g) is supported by native speaker intuitions and phonetic properties (Hintz 2006). Hintz shows that the most accurate cue to stress acoustically is fundamental frequency, although speakers also make use of duration and intensity to signal prominence. Taken together, these cues allow the three levels of stress indicated in (13a–g) to be separated phonetically. See Hintz (2006) for extensive discussion of these results.

Although Hintz does not address the issue in detail, it does not seem to be the case that cyclicity effects are at play, because the clash is often realized within the stem (14a–b).

(14) a. ˈtu.ˌshu-.ku.ˌna-.qa
dance-PL-TOP
'dancers'

b. ˈwa.ˌra:-.ka-.ˌmu-.nqa-.ˌna-.chi
dawn-REFL-TRANS-3FUT-NOW-CONJ
'hopefully it will appear at dawn'
(Hintz 2006:488)

To conclude, we have seen that there are three systems with a clash at the left edge, which can be represented as follows:

(15)	Passamaquoddy, Émérillon	22010
	Tauya	2201
	South Conchucos Quechua	12020

We will now turn to languages with a clash at the right edge.

2.2 *Languages with clashes at the right edge*

Four different right-edge clash patterns have been reported. I will argue that one of these (the Central Alaskan Yupik pattern) should be given an alternative analysis. This leaves three patterns. Two of these are the mirror image of patterns we have seen at the left edge (Ojibwe and Gosiute Shoshone are Passamaquoddy and Tauya backwards, respectively). We will also see a new pattern, in Southern Paiute, in which the clash is not immediately adjacent to the edge of the word.

2.2.1 *Ojibwe*

Ojibwe stress is documented in Piggott (1983). It has peninitial primary stress and tolerates a clash between the penult and the final (16a–d). Like Passamaquoddy, Ojibwe illustrates the preference for a clash at the edge.

(16)	a.	mi.ˈno.ˌgi	'he is growing well'	012
	b.	na.ˈma.da.ˌbi	'he sits'	0102
	c.	mi.ˈzi.na.ˌhi.ˌgan	'my book'	01022
	d.	ni.ˈna.ma.ˌda.bi.ˌmin	'we sit'	010202
		(Piggott 1983:81)		

There is a phonotactic correlate of this pattern. In the Ottawa dialect, unstressed vowels (and short final vowels) are deleted (17a–b).

(17)	a.	ni.gi:.na.ma.dab.i → ˈngi:n.ˌma.ˌdap	'I sat'
	b.	ni.gi:.na.ma.da.bi.min → ˈngi:n.ˌmad.ˌbi.ˌmin	'we sat'
		(Piggott 1983: 92–93)	

In addition, as Piggott points out, the stress pattern changes predictably after affixation, so that we do not see effects of stress preservation. This is illustrated nicely by the examples in (18a–d).

(18)	a.	mi.ˈzi .na.ˌhi.ˌgan	'book'
	b.	ni-.ˈmi.zi.ˌna.hi.ˌgan	'my book'
	c.	na.ˈma.da.ˌbi	'he sits'
	d.	ni-ˈna.ma.ˌda.bi-.ˌmin	'we sit'
		(Piggott 1983:81)	

In (18a–b), we see that, under prefixation of the possessive marker *mi*, both primary stress and secondary stress on the penult of the stem shift one syllable to the left. In addition, in (18d), we see that stress preservation also does not obtain for final stress, as suffixation causes final stress to shift to the suffix. In this way, we can demonstrate that stress in Ojibwe is determined wholly by the surface form and not is subject to the effects of cyclicity. The pair in (18c–d) is a particularly good illustration of this, as none of the stem syllables stressed when the root is presented in isolation are stressed in the prefixed and suffixed form.

2.2.2 Gosiute Shoshone

Gosiute Shoshone is another reported example of a language that tolerates clashes at the right edge. The main source for this is Miller (1996). As pointed out, Gosiute Shoshone is Tauya backwards, and an example of both the preference for having a clash at the edge and the preference for realizing the clash away from the peak.

Miller describes the basic stress pattern as alternating, with primary stress on the initial syllable, and an apparently optional pattern of clash tolerance by stressing the final syllable (19a–c).

(19)	a.	ˈkin.ˌka	'onion'	12
	b.	ˈhi.pik.ˌka	'drank'	102
	c.	ˈnim.mi.ˌman.ˌtin	'one of us'	1022
		(Miller 1996:698)		

Although Miller does not provide a great deal of data, he does provide a phonotactic correlate of stress, at least for final syllables. Unstressed vowels in the final syllable are devoiced (Miller 1996:697–698). In addition, like Tauya, all of this system's properties are independently attested.

2.2.3 Southern Paiute

A novel clash-tolerating pattern is found in Southern Paiute. The main source for Southern Paiute is Sapir (1930), though a variety of analyses have been given (e.g. Harms 1966; Wheeler 1979). Sapir describes Southern Paiute as having fixed primary peninitial stress and a systematic clash between the penult and antepenult in even-numbered words.

There is a pretty reliable phonotactic correlate of stress in Southern Paiute. Unstressed vowels are liable to undergo devoicing (depending on a few environmental factors, particularly this happens before voiceless geminated obstruents, and, if long, vowels merely shorten).

Some of the relevant alternations are shown in (20a–e). I indicate devoicing by means of capitalization, following Sapir.

(20)	a.	ˈa.mA	'with it'	10
	b.	tI'.ˈqa.q'A	'several eat'	010
	c.	qa.ˈni.ˌan.gA	'his house'	0120
	d.	pU.ˈca.xa.ˌi.ˌpi.xa	'looked for'	010220
	e.	nam.ˈpuc.:a.ˌxa.I.ˌpi.xa	'looked for trail'	0102020
	f.	ti.ˈva.qaŋ.ˌwa.i.ˌyu.ˌcam.pA	'though not killing game'	01020220
		(Sapir 1930:39–40)		

The difference between the initial syllables of (20b) and (20c) shows that the initial syllable is unstressed (since it is devoiced before a voiceless geminate). Similarly, the devoicing contrasts between (20d) and (20e) track the position of stress under a 010220 parse. That the penult is stressed and therefore protected from devoicing is illustrated by (21a–b).

(21)	a.	tA.ˈcip.ˌ:ax.:U	'when it was evening'	0120
	b.	ma.ˈro.Oq.ˌwa.ˌyiq.:wA	'stretch it'	010220

In both these words, the penult is in a devoicing context for unstressed vowels. It is followed by a voiceless geminate (a similar geminate triggers devoicing of the first vowel in ((21c), for instance). It is nevertheless voiced.

That stress preservation effects do not play a role in this stress pattern, as noted by Sapir, is illustrated well by the pair in (20d–e). Here we see that the addition of the root *nam* ('trail') causes stress to shift reliably to the left.

An unusual feature of the Southern Paiute pattern, from the perspective of the overall typology, is that it is the only language in this typology to consistently realize the clash away from the edge of the word. I discuss this in more detail in section 3.

2.2.4 Central Alaskan Yupik

The last language that I will discuss is Central Alaskan Yupik (CAY), which has been claimed to be the reverse of South Conchucos Quechua (e.g. Kager 2001). I will argue, however, that the clash-tolerating pattern in Central Alaskan Yupik is not a part of the core stress system and more plausibly viewed as a reflex of higher level stress processes, in this case marking the boundary of a phonological phrase. The same conclusion is reached in Alber (2005) and Gordon (2002). The description here is based on Miyaoka (2011), which contains an extensive discussion of stress in Central Alaskan Yupik.

According to Miyaoka (2011), the basic stress pattern is in (22a–d):

(22) a. qa.ˌya:.li.ˈqa:.tar.tut 020100
'they are about to make a kayak'

b. ˌang.ya.ˌli:.qa.ˈtar.tut 202010
'they are about to make a boat'

c. ma.ˌqi:.qa.ˌta:.lli.ˈni:.lu.ni 02020100
'now I see he is about to take a steambath'

d. ˌqus.ngir.ˌngal.ngur.ˌtang.qerr.ˌsug.nar.ˈquq.llu.gguq 20202020100
'they say there seems to be a goat also'

CAY is a binary stress language. Initial syllables are unstressed if light, but stressed if closed, and stress is rightmost. The final syllable is extrametrical, and the language appears to tolerate a right edge lapse systematically.

The basic pattern then is not a clash-tolerating one. In contrast, clash tolerance only arises in a restricted set of circumstances. Specifically, it comes about only when a prosodic word is closely followed by another word. In these cases, the final syllable of the prosodic word has to carry a pitch accent. This is illustrated by (23a–c).

(23) a. nu.ˈna:.ka 010
land.ABS.1SG.SG
'my land'

b. nu.ˌna.ka-ˈllu-gguq 02010
land.ABS.1SG.SG.and.REP
'my land too, they say"

c. nu.ˌna:.ˈka tanem 021
land.ABS.1SG.SG EXCL
'my land!"

This clash pattern looks like it is created by a final accent not associated with the basic stress pattern, but rather with something else, like marking the end of a phonological phrase.

That this kind of analysis is on the right track is confirmed by looking at suffixes that carry an inherent stress, like *-qer* ('suddenly'). These have a different effect from the final pitch accent described above, in that they cause a disruption of the stress pattern to avoid a clash. We can see this in the pair (24a–b). In (24a), the suffix with lexical accent causes gemination of the initial syllable, so that a stress clash is avoided. In (24b), a homophonous suffix without inherent stress is used instead and we get the normal stress pattern.

(24) a. ˌmay.:u-ˈqer-tuq 2010
go.up-suddenly-IND.3SG
'he is going up suddenly'

b. ma.ˈyu:-qer-tuq 0100
go.up-ITS-IND.3SG
'he is going up a while'

This suffix demonstrates what the effect is of adding an exceptionally stressed syllable to the basic stress system. It does not result in a clash. We can conclude then that the clash-creating utterance-medial accent is not a part of the core stress assignment system. Rather, it is probably best analyzed as a reflex of higher-level intonational processes, such as phonological phrasing.

This means that we have arrived at the following typology of clash tolerance in quantity-insensitive systems (rows indicated placement of primary stress, and columns indicate the position of the clash):

Table 6: The typology of clash-tolerating quantity-insensitive languages

	Initial+Peninitial	Antepenult+Penult	Penult+Final
Initial	South Conchucos Quechua 1202020	—	Gosiute Shoshone 102022
Peninitial	—	Southern Paiute 01020220	Ojibwe 0102022
Penult	Passamaquoddy, Émérillon 2202010	—	—
Final	Tauya 220201	—	—

Although this typology is small, two descriptive generalizations emerge. Clashes are usually realized at the edge opposite primary stress. This is true in six out of seven languages. The only exception is South Conchucos Quechua and we can understand this exception from the perspective of the second generalization, which is that clashes are realized at the edge of the word. Because of consistent non-finality, this preference can only be satisfied in South Conchucos Quechua by realizing the clash with primary stress. The only exception to the generalization that clashes are realized at the word edge is Southern Paiute, in which the clash falls between the penult and antepenult. This exception is again understandable given the properties of Southern Paiute. Southern Paiute has primary peninitial stress, so that the initial syllable is consistently unstressed. As a result, neither word edge is available for realizing the clash. Given these constraints, Southern Paiute actually does show evidence of the preference for clashes to be peripheral. In particular, in eight-syllable words, the clash cannot be realized medially, and must be between the penult and antepenult, in this way putting the clash as close to the edge as possible.

We can see then clearly see that clash placement is regulated by two concerns: a preference for clashes to be peripheral, and a dispreference for clashes involving the primary stress. If taken as violable constraints, all the languages in the sample conform to these pressures.

This typology provides a good testing ground for theories of stress, because it is relatively self-contained. In the rest of this paper, I will explore different models of stress and argue that the above typology is best captured in a *non-directional* model (Kager 2001; McCarthy 2003; Buckley 2009).

3 Clash preference in directional models

I will first discuss directional approaches to stress assignment, such as gradient alignment (Gordon 2002; Alber 2005) or serial models (Prince 1983). I will demonstrate that such systems face the problem that they cannot encode the preference for realizing clashes away from the peak. This is because directional models assume that stress assignment in any particular language comes with a directional bias, independent of other preferences. Such approaches then make the prediction that this directional bias should be able to override preferences for clash placement, contrary to fact.

3.1 A gradient alignment approach

As previously discussed, clash preferences can be encoded using gradient alignment (e.g. Gordon 2002; Alber 2005), because such constraints allow us to favor a particular edge. For Tauya, for instance, we would say that Align-L dominates Align-R, as Table 7 shows.

Table 7: Gradient alignment in Tauya

	Initial	Final	*Lapse	Align-L	Align-R
a. ☞ 220201				*********	***********
b. 202021				**********!*	*********
c. 202201				**********!	**********
d. 020201	*!			*********	******

The advantage of such an approach is that it directly captures one of the two generalizations that drive the typology of clash tolerance: the preference for clashes to be peripheral. Moreover, gradient alignment deals well with the one system in which the clash is not aligned with the word edge, Southern Paiute.

For Southern Paiute, we just posit undominated non-finality and initial extrametricality (at least for the purposes of primary stress).[1] If it then favors ALIGN-R over ALIGN-L, the preference for realizing the clash between the antepenult and penult emerges:[2]

Table 8: Gradient alignment in Southern Paiute

			NONINITIAL	NONFINALITY	*LAPSE	ALIGN-R	ALIGN-L
a.	☞	01020220				13	15
b.		01022020				14!	14
c.		01202020				15!	13

In this way, gradient alignment explains why the pressure towards a peripheral clash still obtains if neither edge is available.

However, the problem with gradient alignment is that it cannot accommodate the dispreference for having the clash involve primary stress. This is because constraints such as ALIGN-R and ALIGN-L are independent of primary stress placement.

To see this, consider a hypothetical system, a variant of Tauya, in which the clash is realized with the primary stress instead. This is possible under gradient alignment, if ALIGN-R is highly-ranked, as the following tableau demonstrates:

Table 9: Hypothetical variant of Tauya

			INITIAL	FINAL	*LAPSE	ALIGN-R
a.	☞	202021				*********
b.		220201				**********!*
c.		202201				**********!
d.		202010		*!		*********

[1] I discuss the issue of enforcing fixed primary peninitial stress in more detail in section 5.

[2] For ease of exposition, the number of violations are indicated numerically in this tableau.

If we posited a constraint against clashes with the primary stress, such as Kager's (2001) *Clash-with-Peak, it would not help matters. If dominated by Align-R, it would simply be inoperative:

Table 10: *Clash-with-Peak outranked by Align-R

	Initial	Final	*Lapse	Align-R	*C-with-Peak
a. ☞ 202021				*********	*
b. 220201				**********!*	
c. 202201				**********!	
d. 202010		*!		*********	

To make matters worse, if a constraint such as *Clash-with-Peak were to dominate Align-R, it would not have the desired effect, as Align-R would still pull the clash towards the right edge. This results in a system in which the clash must be *near* the right edge, but not adjacent to it because of the primary stress, as demonstrated in the following tableau:

Table 11: Align-R outranked by *Clash-with-Peak

	Initial	Final	*Lapse	*C-with-Peak	Align-R
a. 202021				*!	*********
b. 220201					***********!
c. ☞ 202201					**********
d. 202010		*!			*********

We then have no effective means of overriding the independent directional bias that constraints such as Align-L and Align-R entail. As a result, we cannot encode the dispreference for clashes involving the primary stress using gradient alignment.

This means that, for all of systems that involve a clash between secondary stresses, a gradient alignment approach must predict the existence of a system with the same essential profile, but with a clash at the edge where the primary stress is located. This means, for example, that the following five systems are predicted to exist:

(25) a. Unattested (primary initial, clash initial+peninitial, no extrametricality):
120202
b. Unattested (primary penult, clash antepenult+penult, Initial over Align-R):
2020210
c. Unattested (primary penult, clash antepenult+penult, Align-R over *Clash):
02020210
d. Unattested (primary final, clash penult+final, Initial over Align-R):
202021
e. Unattested (primary final, clash penult+final, Align-R over *Clash):
0202021

It is hard to see how this prediction can be avoided in a gradient alignment approach. As a result, gradient alignment fails to capture the generalization that clashes are preferentially realized at the edge opposite primary stress.

It is worth noting, finally, that clash placement is particularly problematic within Alber's (2005) approach to gradient alignment. Alber proposes that there is no Align-R, but only Align-L. Three of the six attested systems involve a systematic clash at the right edge, however (see section 2.2). These cannot be generated in Alber's (2005) model.

3.2 Serial models

Serial models of stress assignment, in which one stress is placed at a time, suffer from the same problem: they cannot encode the preference for a clash at the edge opposite primary stress. This is because they are myopic in nature. When a stress is put down, the system cannot anticipate whether a clash will be necessary. Because of this, all but the last stress can be placed without inducing a clash. This means that we can naturally derive the fact that clashes are peripheral. However, it gives us no handle on the dispreference for a clash with primary stress, because, as discussed below, we cannot prevent stress assignment from starting at the edge opposite primary stress (thus necessitating that the clash involve the peak).

These objections obtain for models such as Prince's (1983) grid-based approach and also to serial OT frameworks, such as Harmonic Serialism (e.g. Pruitt 2010). I will demonstrate this for Prince (1983), but essentially the same problems arise for other serial models.

Prince (1983) develops an approach to stress using the grid that similarly takes stress assignment to have a directionality to it, independent of primary stress placement. Because of this, it suffers from the same problem as gradient alignment: it cannot capture the preference for realizing the clash at the edge opposite main stress.

Let us first outline Prince's approach. Prince proposes that the grid is constructed by an operation called *Perfect Grid Construction*, which places alternating grid marks, either from *left-to-right* (LR) or from *right-to-left* (RL).[3] This operation places grid

[3]In addition, Perfect Grid Construction is parametrically specified for whether it applies *peak-first*

marks one at a time and has the option, parametrically available, of *Forward Clash Override* (FCO), which ignores clashes in favor of eliminating lapses.

This system allows for the preference for clashes to be peripheral to be captured straightforwardly, because it assigns stress incrementally. As a result, the last grid mark placed will be clash-inducing, and so will be peripheral. This is demonstrated in (26a–c), which reflect Gosiute Shoshone. I assume that primary initial stress and fixed final stress are in place.[4] Perfect Grid Construction operates from left-to-right and is subject to Forward Clash Override.

```
(26)  a. x
         x         x
         x x x x x x
      b. x
         x   x     x
         x x x x x x                    (PG;LR;FCO)
      c. x
         x   x   x x
         x x x x x x                    (PG;LR;FCO)
```

Because it operates incrementally, medial stresses, such as in (26b), can be placed in compliance with clash avoidance. It is only at the last grid mark that a clash must be tolerated, so that the clash is realized peripherally. As with gradient alignment, the generalization that clashes are realized peripherally then comes for free.

The problem, however, is that, as with gradient alignment, the directionality of stress assignment is independent of the placement of primary stress. Nothing therefore prevents stress assignment from operating in the opposite direction in a system like Gosiute Shoshone, so that the clash is realized at the other end. This is demonstrated in (27a–c).

```
(27)  a. x
         x         x
         x x x x x x
      b. x
         x     x   x
         x x x x x x                    (PG;RL;FCO)
      c. x
         x x   x   x
         x x x x x x                    (PG;RL;FCO)
```

or *trough-first* (i.e. whether it starts by putting down a stress or not, when a choice arises). I will ignore this here, although it creates additional complications for clash placement in systems in which stress is fixed at the penult or peninitial, such as South Conchucos Quechua, Southern Paiute, Passamaquoddy, or Émérillon.

[4]For ease of exposition, I am abstracting away from the workings of the End Rule, which applies interspersed in the derivation to yield fixed initial/final stress and the placement of primary stress.

This means that Prince's (1983) grid approach suffers from the same problem that gradient alignment does: it cannot capture the preference for realizing a clash away from the edge with primary stress.

Note that we cannot solve this problem by stipulating a restriction on directional stress assignment, so that it must start at the edge that carries primary stress. This works for the majority of cases, except for South Conchucos Quechua, which crucially requires stress assignment to *terminate* at the edge with primary stress.

To sum up the discussion so far, I have argued that the typology of clash-tolerating quantity-insensitive languages displays a preference for clashes opposite primary stress. In this section, I have demonstrated that *directional* approaches to stress assignment cannot capture this generalization. In the rest of this paper, I will show that a non-directional, categorical approach to stress assignment fares better and is capable of encoding the dispreference for clashes with the peak.

4 Clash placement within a non-directional model

An alternative to a directional approach is to adopt a non-directional view of stress assignment (Kager 2001; McCarthy 2003; Buckley 2009). In such an approach, sometimes called a "categorical" approach, stress is modeled using non-gradient locally stated constraints. In this section, I will introduce Kager's clash-licensing constraints, formulated within this approach, and how they deal with the generalizations described in section 2. Although these constraints fare better than directional models, I will identify some problematic predictions to do with placement of primary stress. I show how these can be eliminated by collapsing *Clash and *Clash-with-Peak into one constraint.

4.1 Clash-licensing constraints

Because there is no directional bias in a categorical approach, no clash preferences come for free. Without additional constraints, a medial clash is just as well-formed as a peripheral clash, unlike in directional models. Kager (2001) proposes a set of such constraints, which directly evaluate the wellformedness of clashes. These constraints reflect the descriptive generalizations outlined in section 2. The first of them, Clash-at-Edge, assigns a violation mark for every non-peripheral clash. The second, *Clash-with-Peak, penalizes clashes involving the primary stress.

(28) Clash-at-Edge:
Every clash should be at the edge of a prosodic word.
*Clash-with-Peak:
Assign a violation mark for a clash with the primary stress.
(Kager 2001: 10–11)

Kager speculates that Clash-at-Edge reflects a general desire to place stresses at the edge of the prosodic word by placing stresses there (in the lapse domain, *Initial-

Lapse and *Final-Lapse are its counterparts). *Clash-at-Peak can be seen as the counterpart to Lapse-at-Peak, since both minimize density of stress around the peak.

To see how these constraints work, consider a system like Tauya, with primary final stress and fixed initial stress.

Table 12: Stress in Tauya

	Initial	Final	*Lapse	C-at-Edge	*C-with-Peak
a. ☞ 220201					
b. 202021					*!
c. 202201				*!	

Clash-at-Edge rules out medial clashes, ensuring that candidate (c) does not surface. *Clash-with-Peak then adjudicates between candidates (a) and (b), to ensure that the clash is realized in the initial and peninitial syllables.

One downside of these constraints is that they seem quite descriptive in nature. However, treating these preferences as violable allows us to get a handle on some of the otherwise exceptional systems in the typology. Specifically, the South Conchucos Quechua pattern, the only one to involve a clash with the peak, can receive a principled explanation by treating these constraints as violable.[5]

Clash-at-Edge and *Clash-with-Peak are not in conflict in the majority of the systems discussed here and will correctly place the clash at the edge opposite primary stress. In South Conchucos Quechua, however, Clash-at-Edge and *Clash-with-Peak are in conflict, with Clash-at-Edge outranking *Clash-with-Peak, so that we exceptionally get a clash involving primary stress. This is represented in the tableau below.

[5]In addition to this, I will show that at least *Clash-with-Peak (as well as its counterpart Lapse-at-Peak) can be eliminated by making *Clash and *Lapse assess the severity of the clash/lapse in question.

Table 13: Stress in South Conchucos Quechua

	*Lapse	NonFinality	C-at-Edge	*C-with-Peak
a. ☞ 1202020				*
b. 1020220			*!	
c. 1022020			*!*	

These constraints allow us to derive all the systems described in Section 2, except for Southern Paiute, because it does not place a clash immediately at the edge. To capture this system, we have to revise Clash-at-Edge so that it still penalizes medial clashes in such a system. Specifically, I will adopt the idea of the metrical grid (Liberman and Prince 1977; Prince 1983) and propose that Clash-at-Edge is sensitive to all levels of the grid. I then redefine Clash-at-Edge as in (29).[6]

(29) Clash-at-Edge:
Every clash should be at the edge of every level of the grid.
(i.e. Assign a violation mark for every level of the grid a clash is not aligned with.)

The notion that all levels of the grid have an edge will allow us to ensure that a clash is always preferentially realized peripherally, regardless of whether the immediate edge of the word is available.[7] This allows Southern Paiute to be derived, as the table below shows.

[6]This definition of Clash-at-Edge still penalizes a peripheral clash between the antepenult and penult (with unstressed final) over one with a clash that is strictly aligned to the edge of the word. It assigns one violation mark to the former and no violation mark to the latter. This is necessary to ensure that the South Conchucos Quechua system can still be derived. If these two types of clashes were equally good, Clash-at-Edge could not force a clash with the primary stress.

[7]One worry that we might have about this constraint is that it can be rendered inactive if there are constraints that prevent a clash at both peripheries (for example, if a language had a constraint banning stress on a particular vowel preventing both a left-peripheral and a right-peripheral lapse). In such a case, Clash-at-Edge as formulated above predicts that other considerations should determine clash placement (or optionality should result). This is then another way in which the current approach could be differentiated from a serial one, as a serial approach predicts that the clash should still be as close as possible to the favored edge. However, given the rarity of the crucial forms (at least a nine-syllable word would be necessary), this prediction might be difficult to put to the test.

Table 14: Stress in Southern Paiute

	NonInitial	NonFinality	C-at-Edge	*C-with-Peak
a. ☞ 01020220			*	
b. 01020202		*!		
c. 10202020	*!			
d. 01022020			**!	
e. 01202020			*	*!

These clash-licensing constraints then enable us to encode the generalizations that emerge from the typology described in section 2. They allow us to rule out systems which are ruled in by gradient alignment and other serial models, in which a clash is realized with the primary stress even though the opposite edge is available. Such systems do not arise because there is no independent mechanism of directionality that can overrule *Clash-with-Peak. To put it more concretely, in a system with fixed primary initial stress and secondary final stress, no constraint will favor a candidate such as 120202 over 102022. As a result, such systems cannot be generated.

4.2 Problematic predictions of clash-licensing

The approach outlined above is not entirely without its problems, however. As already noted by Kager (2001), *Clash-with-Peak, in particular, predicts the existence of some problematic systems. In this section, I identify two issues with clash-licensing constraints. I will propose a solution to the one of these, by collapsing together *Clash and *Clash-with-Peak. The challenge of eliminating the other problem will be taken up in section 5.

The first problem is that clash-licensing constraints predict the existence of a language which has what I will refer to as a *peak-shifting* system, because it involves a pattern in which primary stress shifts from edge to edge depending on whether a clash has to be tolerated. This hypothetical system arises when constraints governing main stress are ranked below both Clash-at-Edge and *Clash-with-Peak.

This system involves a ranking like in (30), for example:

(30) Initial; Penult >> *Lapse >> Clash-at-Edge >> *Clash-with-Peak >> Leftmost[8]

[8] In this ranking, Penult is a shorthand for whatever constraints generate fixed penultimate stress.

This ranking has the effect of moving main stress around, depending on the number of syllables in the word.

In words with an even number of syllables, this ranking in (30) gives you primary stress on the initial, secondary stress on the penult, with stress alternating in between, as (31) illustrates.

(31) 1020
102020
10202020

However, for words with an odd number of syllables, main stress starts to shift to the other edge, because the satisfaction of the clash-licensing constraints is more important than placement of primary stress. We can illustrate this with the tableau below, for a word with five syllables.

Table 15: Peak shifts in words with an odd number of syllables

	Initial	Penult	*Lapse	C-at-Edge	*C-with-Peak	Leftmost
a. ☞ 22010						*
b. 12020					*!	
c. 10220				*!		

In this tableau, the high ranking of Penult and Clash-at-Edge ensure that the clash surfaces between the initial and the peninitial. However, because *Clash-with-Peak dominates Leftmost, primary stress is prevented from occurring initially, where it normally does.

This means that this hypothetical system has the stress pattern in (32):

(32) *Peak-shifting system:*
10
120
1020
22010
102020

This is not an attested pattern and it has a clear pathological character to it.

One thing that is encouraging, though, is that this is a very specific kind of system. It has to involve fixed secondary penultimate stress. If the fixed stresses were initial and final, then peak-shifting becomes suboptimal due to the availability of realizing the clash word-finally.[9]

The solution proposed by Kager (2001) is to fix the ranking of constraints regulating primary stress, by saying that one of LEFTMOST and RIGHTMOST has to be undominated. Although this solves the problem, also within the confines of the proposal developed here, it is a somewhat stipulative solution. Even admitting the existence of fixed rankings, it is not clear that allowing a *disjunctive* fixed ranking is desirable.

I will pursue a different solution here, the discussion of which I defer until the next section, since the exact type of peak-shifting pathology we have to eliminate will depend on how primary stress is regulated, an issue which I discuss in more detail then.

The second problem associated with clash-licensing constraints is that, assuming *CLASH-WITH-PEAK, we expect there to be languages that only tolerate a clash that does not involve the peak (we would only get clashes in longer words). It seems to be a generalization across clash-tolerating languages that they always tolerate clashes both with secondary and with primary stress (in words that are too short for the clash to only involve secondary stresses).

The problematic ranking that should give rise to such systems involves a ranking of *CLASH-WITH-PEAK above constraints that fix stress placement, but a relatively low ranking of *CLASH. This results in clash avoidance in short words where the clash would involve the peak, as the following tableau demonstrates:

Table 16: Clash avoidance in short words

	*C-WITH-PEAK	INITIAL	FINAL	*LAPSE	*CLASH
a. ☞ 01		*			
b. 21	*!				*

However, in longer words, this system is clash-tolerating, because *LAPSE outranks *CLASH and *CLASH-WITH-PEAK can be satisfied by having the clash involve only secondary stresses:

9 Whether the same prediction is made at the opposite edge depends on whether initial extrametricality is assumed to exist (Gordon 2000; Buckley 2009). I discuss this in more detail in section 5.

Table 17: Clash tolerance in long words

	*C-with-Peak	Initial	Final	*Lapse	*Clash
a. ☞ 2201					*
b. 2001				*!	

This prediction is not obviously pathological in character, but it seems to be a property of the attested clash-tolerating systems that they also tolerate a clash in words short enough to force a clash with the peak. I propose to deal with this generalization in the following way. If we collapse *Clash-with-Peak and *Clash into a single constraint, then the ranking necessary for such a system is no longer possible.[10] A language then cannot selectively tolerate clashes. If it tolerates a clash with secondary stress, it must also tolerate one with primary stress.

This must be done without sacrificing the influence of *Clash-with-Peak on clash placement. I then propose the following redefinition of *Clash.

(33) *Clash:
Assign a violation mark for each grid level involved in a clash.

This constraint penalizes a clash involving primary stress more than it does a clash involving secondary stress, because an extra grid level is involved in the former. This incorporates the intuition that a clash involving primary stress is worse than a clash involving secondary stress, but does not allow for the variable ranking of *Clash-with-Peak and *Clash that led to the problematic system outlined above. This constraint then effectively penalizes clashes on the basis of their severity.

In this way, we have not lost the upside of *Clash-with-Peak in regulating clash placement, but have done away with one of its potentially problematic predictions.

5 Calculating a factorial typology

In this section, I will demonstrate that the clash-licensing constraints proposed here derive a restrictive typology. Using OTSoft (Hayes, Tesar, and Zuraw 2013), I calculate a factorial typology, which is shown to be able to incorporate the descriptive generalizations outlined in section 2, while maintaining a restrictive overall typology of binary systems.

5.1 Fixing (primary) stress

Before calculating a factorial typology, it is important to formulate a set of constraints for fixing primary and secondary stress at the edge. This is one of the main chal-

[10]This move is inspired by Heinz et al. (2005), who observe that collapsing constraints in this way can help eliminate problematic systems, by reducing the number of possible rankings.

lenges facing a local, categorical approach to stress along the lines of Kager (2001), McCarthy (2003), or Buckley (2009), particularly when it comes to primary stress. As a result, Kager (2001) and Buckley (2009) opt to give primary stress an exceptional status, either by fixing the way primary stress constraints are ranked or by taking them out of the tableau altogether, by means of a version of Prince's (1983) End Rule.

It is not hard to see why. In a non-gradient approach, fixing stress at the peninitial syllable, as in Southern Paiute, or at the penult, as in Passamaquoddy, is not a trivial task. Because constraints are stated locally, we want to only make reference to adjacent syllables.

One way to do this that may seem attractive initially is to make use of a higher-level prosodic constituent, such as feet or stress windows (Gordon 2002). Stress windows, for example, ban a lapse at the left or right edge, which can be used to fix stress when combined with constraints such as Initial, Final, and extrametricality constraints. However, as Kager (2012) points, such constraints create a midpoint pathology.

Suppose we use the window constraints InitialWindow and FinalWindow to fix primary stress. They are defined as in (34).

(34) InitialWindow:
Assign a violation mark if there is no main stress in the first two syllables.
FinalWindow:
Assign a violation mark if there is no main stress in the last two syllables.

These constraints help fix stress at a particular edge. FinalWindow in conjunction with NonFinality, for example, creates fixed penult stress. The problem arises, however, when both constraints are ranked above other stress-fixing constraints. With a ranking like InitialWindow >> FinalWindow >> Initial, for instance, we get initial stress in every form except a 3-syllable one, because now peninitial stress satisfies both window constraints:

Table 18: Midpoint pathology with stress window constraints

	InitialWindow	FinalWindow	Initial
a. 010			*!
b. 100		*!	
c. 001	*!		
d. ☞ 210			

This yields a system like (35):

(35) 10
210
1020

An alternative that works somewhat better is to adopt footing and use constraints like (see also Buckley 2009):

(36) InitialFoot: Align a foot with the left edge.
FinalFoot: Align a foot with the right edge.

This makes the midpoint pathology system impossible, just because feet cannot overlap. As a result, InitialFoot and FinalFoot cannot be satisfied at the same time in a 3-syllable word.

But a similar problem comes back in 2-syllable words. Because both InitialFoot and FinalFoot can be satisfied by a foot that spans the whole word, we get systems like (37):

(37) (10)
(2)(01)
(2)(20)(1)
(20)(20)(1)

To avoid generating such pathologies, I propose a family of stress-fixing constraints that impose non-overlapping demands, so that they cannot come to "conspire" together in words of a certain length. Specifically, I posit the set of constraints in (38):

(38) **Stress-fixing constraints (version 1):**
Initial: The initial syllable is a unary foot.
Final: The final syllable is a unary foot.
Peninitial: The left edge should be aligned with an iambic foot.
Penult: The right edge should be aligned with a trochaic foot.[11]

These constraints do not generate the midpoint pathologies described above, because they can never work in tandem with each other (except for Initial and Final in a one-syllable word, but this is obviously harmless). Note that, to do so, these constraints make reference to the foot-level. I adopt the notion of metrical feet, although I will not make use of any constraint on foot shape or parsing. This means that footing is underdetermined by the constraint set, as foot shape is only regulated at the edge. As a result, the notion of foot I use is different from the traditional one and can be seen as a marriage between Gordon's (2002) stress windows and the traditional concept of metrical feet. Since medial feet have no real status in this approach, we

[11] It is crucial that a unary foot does not count as a trochaic foot, for the purposes of this constraint.

can conceptualize feet as domains that reflect the prosodic contour of an edge. Each foot starts at the edge of the word and ends at the first stressed syllable closest to that edge.

The next issue is how to incorporate primary stress placement into these constraints. I propose to collapse constraints on primary stress into this constraint set. This will help avoid a set of pathological systems (*cf*. Heinz et al. 2005). Specifically, I posit the notion of *maximal prominence*, which is defined as in (39):

(39) **Maximal prominence:**
If a prosodic constituent α should be *maximally prominent*, assign a violation mark for each level of stress on which a grid mark is not associated with α.

This notion of maximal prominence is a general recipe for assigning violation marks that I will incorporate into the constraints Initial and Final.

We then redefine the constraints in (38) as in (40).

(40) **Stress-fixing constraints (final version):**
Initial: The initial syllable is a *maximally prominent* unary foot.
Final: The final syllable is a *maximally prominent* unary foot.
Peninitial:
The left edge should be aligned with an iambic head foot (e.g. [(01) . . .).
Penult:
The right edge should be aligned with a trochaic head foot (e.g. . . . (10)]).

This is a symmetrical constraint set, in which Initial and Final can also fix secondary stress (if dominated by another stress-fixing constraint), but Peninitial and Penult only fix primary stress.[12]

Before presenting the factorial typology, we have one more issue to consider. In particular, the constraint set proposed above gives us a way of avoiding peak-shifting pathologies in a relatively straightforward manner.

The peak-shifting problem discussed above and noted by Kager (2001) arises in a slightly different manner with the constraint set described above. Specifically, it arises when high-ranked *Clash, *Lapse, and NonFinality create a fixed stress contour (stress has to alternate leftward from the penult), without saying anything about primary stress. This creates a situation in which different stress-fixing constraints can decide primary stress depending on the number of syllables in the word.

For example, suppose Peninitial dominates Penult. This means that, whenever high-ranked *Clash, *Lapse, and NonFinality allow for it, we will get primary peninitial stress. However, in all other words, Penult will decide things and so create primary penultimate stress. Peninitial wins out in words consisting of five syllables, for example:

[12] Fixed secondary stress on the penult arises in this system when a language obeys both NonFinality and *Lapse. An independent mechanism may also be necessary, because there are cases of fixed secondary stress on the penult in dual stress systems. This could be achieved by adding a constraint banning lapses only at the right edge, *Lapse-R.

Table 19: Peak shifts in words with an odd number of syllables

			*Clash	*Lapse	NonFinality	Peninitial	Penult
a.	☞	(01)0(20)					*
b.		(02)0(10)				*!	

However, when we turn to a word in which peninitial stress is made impossible by the high ranking of *Clash, *Lapse, and NonFinality, Penult will win out:

Table 20: Peak shifts in words with an odd number of syllables

			*Clash	*Lapse	NonFinality	Peninitial	Penult
a.	☞	(20)(10)				*	
b.		(01)(20)	*!				*
c.		(01)(02)			*!		*
d.		(01)00		*!			*

As a result, we get the system in (41):

(41) (10)
(01)0
(20)(10)
(01)0(20)
(20)(20)(10)

This, again, clearly has a pathological character. A similar system is created by the ranking of Initial over Penult. This leads to (42):

(42) (1)0
0(10)
(1)0(20)
(02)0(10)
(1)0(20)(20)

We can eliminate these problematic interactions by exploiting the metrical structure we have posited for the stress-fixing constraints. In particular, this pathology can be removed by defining NonFinality so that it demands that the last syllable be unfooted (43):

(43) NonFinality: The final syllable cannot be part of a metrical foot.

The effect of this is that NonFinality and Penult can no longer conspire together to create primary penultimate stress, as NonFinality eliminates the foot structure that Penult exerts an influence on. For the system in (42), for example, stress will now revert to the initial syllable instead of the penult, as NonFinality renders all the right-edge constraints inoperative. This is demonstrated by the following tableau, with low-ranked Initial added to it:

Table 21: Peak shifts in words with an odd number of syllables

		*Clash	*Lapse	NonFin	Peninitial	Penult	Initial
a.	(2)0(10)			*!	*		*
b.	(01)(2)0	*!				**	**
c.	(2)(01)0				*	**	*!
d. ☞	(1)(02)0				*	**	

This results in a system in which primary stress alternates between the initial and peninitial. Gordon (2002:fn. 41) notes that Malakmalak, as described in Birk (1976), has a quantity-insensitive pattern of this type.

5.2 A factorial typology

We can calculate a factorial typology using this constraint set. We have a set of eight constraints so far:

(44) **Constraint set:**
Clash-at-Edge: Every clash should be at the edge of every level of the grid. (i.e. Assign a violation mark for every level of the grid a clash is not aligned with.)
*Clash: Assign a violation mark for every grid mark above three on two adjacent stressed syllables.
Initial: The initial syllable is a maximally prominent unary foot.
Final: The final syllable is a maximally prominent unary foot.
Peninitial: The left edge should be aligned with an iambic head foot (e.g. [(01) ...).
Penult: The right edge should be aligned with a trochaic head foot (e.g.

...(10)]).
NonFinality: The final syllable cannot be part of a metrical foot.
*Lapse: Assign a violation mark for two adjacent unstressed syllables.

To generate a full typology of binary stress systems, we also need to incorporate constraints on lapse placement. Kager (2001) observes that lapses are preferentially realized adjacent to the peak or at the right edge. To capture this, he postulates the constraints Lapse-at-Peak and Lapse-at-End, given in (45).

(45) Lapse-at-Peak: Assign a violation mark for each lapse adjacent to the peak.
Lapse-at-End: Assign a violation mark for each lapse not at the right edge.

Unfortunately, these lapse-licensing constraints also generate a peak-shifting system. This happens in a clash-tolerating when NonFinality is undominated, Lapse-at-Peak and Lapse-at-End are both high-ranked, and the default preference is initial primary stress. This yields a pattern with initial primary stress in most words, except for words with an odd number of syllables starting at five syllables. In those words, the high ranking of Lapse-at-Peak and Lapse-at-End forces antepenultimate stress, as the following tableau demonstrates:

Table 22: Peak shifts with lapse-licensing

			*Clash	NonFin	Lapse-at-Peak	Lapse-at-End	Initial
a.		(1)0(20)0			*!		
b.		(1)(20)(2)0	**!				
c.		(1)0(02)0				*!	
d.	☞	(2)(01)00					*

This results in the stress pattern in (46), which is clearly problematic.

(46) (1)0
(1)00
(1)(02)0
(2)(01)00
(1)(02)(02)0

To solve this problem, I propose collapsing Lapse-at-Peak and *Lapse into one constraint, much like what I suggested for *Clash in section 4. To be precise, I posit that *Lapse penalizes lapses adjacent to secondary stress more heavily than lapses adjacent to primary stress, by assigning an additional violation mark for lapses adjacent only to a syllable with secondary stress. I define *Lapse as follows:

(47) *Lapse:
For each lapse, assign a violation mark for each level of stress that does not have a grid mark adjacent to the lapse.

This version of *Lapse eliminates the peak-shifting system above (and several related problematic interactions). It assigns one violation mark to a lapse adjacent to primary stress and two violation marks to a lapse adjacent only to secondary stress. It can be seen as the counterpart to the redefined *Clash, in that the penalty it awards depends on the severity of the lapse.

With this redefined version of *Lapse, as well as Lapse-at-End, in our constraint set, we can calculate a factorial typology of binary stress systems. This was done using OTSoft (Hayes, Tesar, and Zuraw 2013). The input consists of all possible footings of two-syllable to six-syllable words. This set of 9 constraints generates 27 languages. It contains all the attested quantity-insensitive languages covered by Gordon (2002).[13] However, it has fewer unattested systems than Gordon, whose typology contains 46 patterns.[14] The full set of languages can be examined in the appendix. I will focus on the clash-tolerating languages here.

The typology includes eight clash-tolerating systems. All of these patterns conform to the descriptive generalizations defended in section 2: clashes are preferentially peripheral and avoid primary stress. The typology derives all of the six systems described in section 2:

(48) *Southern Paiute:*
(1)0
(01)0
(01)(2)0
(01)(02)0
(01)(02)(2)0

(49) *Tauya:*
(2)(1)
(2)0(1)
(2)(20)(1)
(2)0(20)(1)
(2)(20)(20)(1)

[13]The one exception is Indonesian, which Gordon takes to have fixed initial secondary stress with a lapse that is tolerated after the initial. Following Kager (2001), I take the Indonesian pattern to be due to stem preservation effects carried over from Dutch, as all the relevant words are Dutch loanwords. If we were to admit the existence of the so-called "initial dactyl" effect, we would have to enrich the set of lapse-licensing constraints.

[14]It is worth keeping in mind, however, that Gordon's constraint set is also designed to deal with single stress, dual stress, and ternary stress languages, which the constraint set developed here does not currently cover. This means that not too much should be read into the larger number of unattested patterns in Gordon (2002). I make the comparison here just to show that the current factorial typology can achieve an adequate level of coverage for non-clash-tolerating systems also.

(50) *Gosiute Shoshone:*
(1)(2)
(1)0(2)
(1)(02)(2)
(1)(02)(02)
(1)(02)(02)(2)

(51) *Ojibwe:*
(01)
(01)(2)
(01)0(2)
(01)(02)(2)
(01)(02)0(2)

(52) *South Conchucos Quechua:*
(1)0
(1)(20)
(1)0(20)
(1)(20)(20)
(1)0(20)(20)

(53) *Passamaquoddy, Émérillon:*
(10)
(2)(10)
(2)0(10)
(2)(20)(10)
(2)0(20)(10)

In addition to these six systems, there are two patterns that are unattested, but combine properties of the attested languages. The first is essentially South Conchucos Quechua, but with *Clash outranking Clash-at-Edge, so that the clash is realized between the antepenult and penult instead of with the peak:

(54) (1)0
(1)(2)0
(1)(02)0
(1)(02)(2)0
(1)(02)(02)0

The second of these is a variant of Southern Paiute with primary peninitial stress in a two-syllable word (55) (Southern Paiute has primary peninitial stress except in a two-syllable word, when stress is initial).

(55) (01)
(01)0
(01)(2)0
(01)(02)0
(01)(02)(2)0

There is no reason to think that this is an impossible system, as a language may plausibly prioritize peninitial stress over NonFinality, even if Southern Paiute does not.

To sum up, I have demonstrated that a non-directional approach to stress, using Kager's (2001) clash-licensing constraints, can capture the two generalizations that characterize the typology of clash-tolerating languages: clashes are preferentially peripheral and clashes involving primary stresses are avoided where possible. I have outlined one way in which these clash-licensing constraints can be employed, using a family of stress-fixing constraints, and shown that we can derive an appropriately restrictive typology which fully obeys these generalizations. Since the same result cannot be attained in directional models of stress, the typology of clash placement constitutes an argument in favor of a categorical approach (Kager 2001; McCarthy 2003; Buckley 2009). In addition, I have identified a few problematic properties of clash-licensing constraints and proposed specific ways of eliminating them.

There are a number of issues that I have not deal with here. Probably the most important one, from the perspective of a categorical approach to stress, is how fixed antepenultimate stress should be dealt with. If the stress-fixing constraints I have proposed are to have general application, they should include constraints that regulate antepenultimate stress. One way of doing this might be to enrich the machinery proposed here with weakly layered feet, as discussed at length by Kager (2012) in his typology of primary stress placement. This mechanism could be incorporated into the approach developed here.[15] This move would yield additional clash-tolerating systems, involving fixed antepenultimate stress. I have not touched on this issue here, primarily because it is unclear whether such languages exist. None of the languages in my sample involve fixed antepenultimate stress and this could reflect a deeper generalization. Systems with fixed antepenultimate stress necessarily involve a lapse at the right edge and it is not implausible to think that all such systems would therefore be lapse-tolerating. If so, this generalization would have to be encoded in some way.

6 Final remarks

This paper has provided a typology of quantity-insensitive clash-tolerating systems. This typology can be characterized by two descriptive generalizations: a) clashes are placed at the edge when possible, and b) clashes with the peak are avoided. I have argued that Kager's (2001) clash-licensing constraints can capture these generalizations and derive a restrictive typology. In contrast, directional approaches to stress assignment, such as gradient alignment, grid construction, or Harmonic Serialism, cannot encode the second of these generalization. As a result, the typology of clash placement is an empirical argument for a non-directional, categorical approach to stress, as pursued in recent work by Kager (2001), McCarthy (2003), and Buckley (2009). In addition to, I have identified several problematic interactions to do with Kager's clash-licensing constraints and shown how these can be eliminated.

[15] It would be important, though, to modify NonFinality so as to also repel weakly layered feet. Otherwise, peak shift becomes a problem again.

References

Alber, Birgit. 2005. Clash, lapse, and directionality. *Natural Language & Linguistic Theory* 23:485–542.

Birk, David. 1976. *The Malakmalak language, Daly River (Western Arnhem Land)*. Canberra: Australian National University.

Buckley, Eugene. 2009. Locality in metrical typology. *Phonology* 26:389–435.

Dubert, Raymond, and Marjorie Dubert. 1973. Biangai phonemes. In *Phonologies of three languages of New Guinea*, 5–36. Ukarumpa, Papua New Guinea: Summer Institute of Linguistics.

Gordon, Matt. 2002. A factorial typology of quantity-insensitive stress. *Natural Language & Linguistic Theory* 20:491–552.

Gordon, Matt, and Francoise Rose. 2006. Émérillon stress: A phonetic and phonological study. *Anthropological Linguistics* 48:132–168.

Hagstrom, Paul. 1997. Contextual metrical invisibility. *MIT Working Papers in Linguistics* 30.

Harms, Robert. 1966. Stress, voice, and length in Southern Paiute. *International Journal of American Linguistics* 32:228–235.

Hayes, Bruce, Bruce Tesar, and Kie Zuraw. 2013. OTSoft 2.3.2. Software package, http://www.linguistics.ucla.edu/people/hayes/otsoft/.

Heinz, Jeff, Kobele, Greg, and Jason Riggle. 2005. Exploring the typology of quantity-insensitive systems. Unpublished handout.
http://home.uchicago.edu/ gkobele/files/HeinzEtAl05.pdf.

Hintz, Diane. 2006. Stress in South Conchucos Quechua: A phonetic and phonological study. *International Journal of American Linguistics* 72:477–521.

Hyde, Brett. 2002. A restrictive theory of metrical stress. *Phonology* 19:313–359.

Hyde, Brett. 2008. Bidirectional stress systems. *Proceedings of WCCFL 26*.

Kager, René. 1989. *A metrical theory of stress and destressing in English and Dutch*. Dordrecht, The Netherlands: Foris.

Kager, René. 2001. Rhythmic directionality by positional licensing. Handout of a presentation at HILP5, University of Potsdam. ROA-514.

Kager, René. 2005a. Rhythmic Licensing Theory: An extended typology. In *Proceedings of the Third International Conference on Phonology*, 5–31. Seoul: The Phonology-Morphology Circle of Korea.

Kager, René. 2005b. The factorial typology of rhythmic licensing constraints. *Phonological Studies* 5:47–155.

Kager, René. 2012. Stress in windows: Language typology and factorial typology. *Lingua* 122:1454–1493.

de Lacy, Paul. 2007. Quality of data in metrical stress theory. *Cambridge Extra Magazine*. Issue 2.

LeSourd, Phil. 1988. *Accent and syllable structure in Passamaquoddy*. Doctoral dissertation, MIT.

LeSourd, Phil. 1993. *Accent and syllable structure in Passamaquoddy*. New York: Garland.

MacDonald, Lorna. 1990. *A grammar of Tauya*. Berlin: Mouton de Gruyter.

McCarthy, John. 2003. OT constraints are categorical. *Phonology* 20:75–138.

Miller, Wick. 1996. Sketch of Shoshone, a Uto-Aztecan language. In *Handbook of American Indian Languages, vol. 17 Languages*, ed. by I. Goddard, 693-720. Washington: Smithsonian Institute.

Miyaoka, Osahito. 1985. Accentuation in Central Alaskan Yupik. In *Yupik Eskimo prosodic systems: Descriptive and comparative studies*, ed. by M. Krauss, 51–75. Fairbanks, AK: University of Alaska.

Miyaoka, Osahito. 2011. *A grammar of Central Alaskan Yupik: An Eskimoan language*. Manuscript.

Pater, Joe. 2000. Non-uniformity in English secondary stress: The role of ranked and lexically specific constraints. *Phonology* 17:237–274.

Piggott, Glyn. 1983. Extrametricality and Ojibwa stress. *McGill Working Papers in Linguistics*.

Pruitt, Kathryn. 2010. Serialism and locality in constraint-based metrical parsing. *Phonology* 27:481–526.

Pike, Kenneth L. 1964. Stress trains in Auca. In *In honour of Daniel Jones*, ed. by David Abercrombie, Dennis Fry, P. A. D. MacCarthy, N. C. Scott, and J. L. M. Trim, 425–431. London: Longmans.

Prince, Alan. 1983. Relating to the grid. *Linguistic Inquiry* 14:19–100.

Sapir, Edward. 1930. Southern Paiute, a Shoshonean language. *Proceedings of the Academy of Arts and Sciences* 65(1).

Wheeler, Deirdre. 1979. A metrical analysis of stress and related processes in Southern Paiute and Tubatulabal. *University of Massachusetts Working Papers in Linguistics 5*, 145–175.

Appendix: The factorial typology[16]

Simple binary:

(1)	(01) (01)0 (01)0(2) (01)(02)0 (01)(02)0(2)	(2)	0(1) (2)0(1) (02)0(1) (2)(02)0(1) (02)(02)0(1)	(3)	(1)0 (01)0 (1)(02)0 (01)(02)0 (1)(02)(02)0
(4)	(1)0 (1)0(2) (1)(02)0 (1)(02)0(2) (1)(02)(02)0	(5)	(10) 0(10) (2)0(10) 0(20)(10) (2)0(20)(10)		

Clash-tolerating:

(6)	(01) (01)0 (01)(2)0 (01)(02)0 (01)(02)(2)0	(7)	(01) (01)(2) (01)0(2) (01)(02)(2) (01)(02)0(2)	(8)	(1)0 (01)0 (01)(2)0 (01)(02)0 (01)(02)(2)0
(9)	(1)0 (1)(2)0 (1)(02)0 (1)(2)(02)0 (1)(02)(02)0	(10)	(1)0 (1)(2)0 (1)(02)0 (1)(02)(2)0 (1)(02)(02)0	(11)	(10) (2)(10) (2)0(10) (2)(20)(10) (2)0(20)(10)
(12)	(1)(2) (1)0(2) (1)(02)(2) (1)(02)0(2) (1)(02)0(2)(2)	(13)	(2)(1) (2)0(1) (2)(20)(1) (2)0(20)(1) (2)(20)(20)(1)		

[16]Note that the footing is underdetermined by my constraint set, because no constraint affects the choice of medial footing. For ease of exposition, I have chosen a particular footing in each such case, either for esthetic reasons or purely arbitrarily. Nothing hinges on this.

Lapse-tolerating:

(14) (01)
(01)0
(01)00
(01)(02)0
(01)(02)00

(15) (01)
(01)0
(01)00
(01)(02)0
(01)0(02)0

(16) (01)
(01)0
(01)0(2)
(01)00(2)
(01)(02)0(2)

(17) 0(1)
(2)0(1)
(2)00(1)
(2)(02)0(1)
(2)0(20)0(1)

(18) (1)0
(1)00
(1)(02)0
(1)0(20)0
(1)(02)(02)0

(19) (1)0
(1)00
(1)(02)0
(1)0(02)0
(1)(02)(02)0

(20) (1)0
(01)0
(01)00
(01)(02)0
(01)(02)00

(21) (1)0
(01)0
(01)00
(01)(02)0
(01)0(02)0

(22) (1)0
(1)0(2)
(1)00(2)
(1)(02)0(2)
(1)0(02)0(2)

(23) (10)
0(10)
(2)0(10)
(2)00(10)
(2)0(20)(10)

Lapse-tolerating, clash in short words:

(24) (01)[17]
(01)(2)
(01)0(2)
(01)00(2)
(01)(02)0(2)

(25) (10)
(2)(10)
(2)0(10)
(2)00(10)
(2)0(20)(10)

(26) (2)(1)
(2)0(1)
(2)00(1)
(2)0(20)(1)
(2)0(20)0(1)

(27) (1)(2)
(1)0(2)
(1)00(2)
(1)(02)0(2)
(1)0(02)0(2)

[17] This is the only system generated by my constraint set that is absent in Gordon's (2002) typology. It is unattested.