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Competition and gradience: A representational account of suffix-induced accentuation in Tokyo Japanese

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This paper presents a unified analysis of suffix-induced accent patterns in Tokyo Japanese, comprising dominance, preaccentuation, subtraction, and attraction. I argue that these patterns are derived within a single phonological grammar using autosegmental representations enriched with gradient activity (Smolensky & Goldrick 2016). Suffix classes are specified with H-tones and moras that vary in activity level and association status (associated vs. floating). Surface patterns follow from the interaction of two principles: (i) competition among gradiently active H-tones and moras, in which the most active elements win, and (ii) a rightmost preference for tone realisation. These principles are formalised in Harmonic Grammar (Legendre & Miyata & Smolensky 1990) through independently motivated constraints on tone–mora association and alignment. The account unifies a broader range of patterns than previous analyses while maintaining the Indirect Reference Hypothesis.

1 Introduction

The lexical accent system of Tokyo Japanese presents a persistent challenge for existing theoretical accounts, such as Transderivational Antifaithfulness (Alderete 1999), head dominance (Revithiadou 2007), and lexical indexation (Kurisu 2001). Among the most discussed phenomena in the Japanese accent system are suffix-induced accentuation patterns, which display a diversity that extends beyond the familiar dichotomies of accented vs. unaccented and dominant vs. recessive. Japanese suffixes fall into multiple accentual classes: dominant, recessive, dominant/recessive preaccenting, subtractive, and attractive. Dominant suffixes impose their own accent and delete any preexisting accent; preaccenting suffixes assign an accent to the syllable immediately preceding them, dominantly or recessively; subtractive suffixes delete a preexisting accent without contributing a new one; and attractive suffixes shift an existing accent. It is rare for such a diverse set of accent patterns to co-occur in a single system, and the subtractive and attractive patterns in particular pose significant challenges for existing theoretical frameworks.

In this paper, I propose a representational account of Japanese suffix accentuation that combines two independently motivated theoretical frameworks: autosegmental representations (Goldsmith 1990) and Gradient Symbolic Representations (GSR) (Smolensky & Goldrick 2016). The analysis explores the predictions that arise from enriching autosegmental representations with gradient activity, in which tones and tone-bearing units (TBUs) may be associated or floating and may vary in their underlying activity. These representational differences allow a single phonological grammar to derive the full range of suffix-induced accent patterns through competition among H-tones and TBUs (mora in Japanese) with differing degrees of activity. More concretely, preaccentuation arises when a strong floating H-tone overrides a weaker underlying H-tone and docks onto an adjacent morpheme. Attraction results from a strong mora drawing an existing tone onto itself. Finally, subtraction emerges when strong floating moras attract a preexisting tone and prevent its realisation on the surface. These processes are captured by standard, independently motivated constraints on tone–TBU association in Input–Output Correspondence Theory (McCarthy & Prince 1995; Yip 2002). This account unifies a broader range of accentual patterns than previous analyses, which capture only a subset of the data (as discussed in Section 5). Crucially, it maintains the Indirect Reference Hypothesis, setting the account apart from alternative approaches that rely on constraint indexation (Alderete 1999; Kurisu 2001), Transderivational Antifaithfulness (Alderete 1999), or theoretically unmotivated operations such as vertical concatenation (Trommer 2019a) and negative activation (Kushnir 2019).

The remainder of the paper is structured as follows: Section 2 presents the tone system of Tokyo Japanese, focusing on the accentual behaviours of suffixes. Section 3 introduces the core assumptions of gradient autosegmental representations implemented in Harmonic Grammar. Section 4 develops the analysis of suffix accentuation within this framework. Section 5 compares the proposal with existing alternatives, and Section 6 concludes the paper.

2 Data: Japanese accent

Previous studies have provided detailed descriptions of the Japanese accent system. This section provides a brief overview of the relevant accentuation patterns, focusing on simple nouns (Section 2.1) and suffixed nouns (Section 2.2). The emphasis is on the different accentual classes of suffixes that serve as the empirical basis for the analysis developed in this paper.

2.1 Native noun and loanword accentuation patterns

The Japanese accent system exhibits culminativity but not obligatoriness: at most one prominence is allowed within a word, whether simple or complex. The language allows for contrastive accent specification, both in terms of presence vs. absence and location, yielding minimal pairs such as (1). Japanese shows a so-called ‘N + 1’ accent pattern for words with N syllables, where N is an integer greater than or equal to one (McCawley 1968) (2).

(1) Contrastive lexical accent in Japanese (Kawahara 2015: 448)

a.	ame-ga	‘candy-Nom’	b.	káta-ga	‘shoulder-Nom’
	áme-ga	‘rain-Nom’		katá-ga	‘frame-Nom’

(2) N + 1 accent patterns for three-syllable nouns

a.	ínoti	‘life’	c.	atamá	‘head’
b.	kokóro	‘heart’	d.	miyako	‘city’

While native nouns exhibit unpredictable lexical accent, loanwords generally follow a default accentuation pattern that places the accent on the syllable containing the antepenultimate mora (3-a) (McCawley 1968)[1]. When a word lacks an antepenultimate mora, the accent falls on the penultimate syllable (3-d). In cases where the antepenultimate mora is prosodically deficient, such as a moraic nasal, the first half of a geminate, or the second part of a long vowel, the accent shifts leftward to the preantepenultimate mora, which is the head of the syllable (3-b,c).

(3) Antepenultimate default accent in Japanese (Kawahara 2015: 453,454)

a.	kurisúmasu	‘Christmas’
b.	guránpuri	‘Grand prix’
c.	páapuru	‘purple’
d.	móka	‘mocha’

A brief note on surface tonal patterns in Japanese is warranted here. The standard representation of Japanese accent is a HL tonal complex (Kawahara 2015; Ito & Mester 2018). As noted by

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[1] See Mutsukawa (2005) for arguments against the antepenultimate pattern as the default, based on English loanwords. See also Haraguchi (1977; 1999) and Kubozono (1996; 2008; 2011) for analyses proposing the Latin Stress Rule as the basis of Japanese default accentuation.

Kawahara (2015: 449–450), aside from tones assigned by lexical accent, the first two syllables of a Japanese word typically bear a LH tonal sequence, often referred to as initial lowering or initial rise, unless the first syllable is accented, in which case the word exhibits the accentual HL fall instead. When syllables do not receive a tonal specification from either accent or initial rise, their tonal realisation is derived through spreading from the rightmost specified tone. This spreading is often analysed as phonetic interpolation, suggesting that such syllables are phonologically toneless even at the surface level (Pierrehumbert & Beckman 1988). Since this study focuses on suffix-induced accent patterns, it does not attempt to model surface tonal interpolation.

2.2 Suffix-induced accentuation patterns

The accentuation of suffixed words in Japanese is largely unpredictable and depends on the accentual type of the suffix. While roots are generally classified as either accented or accentless, suffixes resist this binary distinction and fall into a range of accentual classes. Crucially, suffixes contribute to word accentuation in ways that cannot be reduced to their inherent accent. They have been categorised into dominant, recessive, preaccenting, subtractive (referred to here as usurper), and accent-shifting, as summarised in Table (4). The classification of suffixes is based on previous work, including Poser (1984), Alderete (1999), and Kawahara (2015). It should be noted, however, that the suffixes presented in these sources do not always form a homogeneous morphological class, and their status as true suffixes is sometimes debated. This issue is orthogonal to the central claim of the present paper, as the proposed analysis treats all forms uniformly within word-level phonology, regardless of their precise morphological classification (see Section 4). For the sake of consistency with the existing literature, I retain the traditional terminology here.

(4) Accentual classes of suffixes in Japanese (Poser 1984; Kawahara 2015)

Accented		Accentless					
Dominant	Recessive		Preaccenting		Usurper	Accent-shifting	
			Dominant	Recessive		Attractive	Adsorbent
-ppói	-tára	-ga	-ke	-si	-teki	-mono	-te
'-ish'	COND	NOM	'family of'	'Mr.'	'-like'	'thing'	'who Vs'

I now turn to each suffix class and the accent patterns that emerge from their interaction with accented and accentless roots. We begin with the pure recessive, which comes in two types: accentless and accented. The nominative marker /-ga/ represents the accentless subtype. It is 'recessive' in that it cannot modify a preexisting accent and 'accentless' in that it does not surface with an accent when combined with an accentless root (5-a). The conditional suffix /-tára/

represents the accented subtype: it realises its accent when combined with an accentless root, while the root retains its accent over that of the suffix (5-b)[2].

(5) Recessive suffixes: accentless and accented (Kawahara 2015: 447; Alderete 1999: 156)

	root	suffixed	
a.	ame	ame-ga	‘candy’ (NOM)
	áme	áme-ga	‘rain’ (NOM)
b.	yob	yon-dára	‘if he calls’
	yóm	yón-dara	‘if he reads’

The next class is the dominant accented suffix class, exemplified by /-ppói/ ‘-ish’. This suffix realises its accent regardless of whether the root is accentless (6-a) or accented (6-b). In cases where the root is already accented, the root accent is deleted to satisfy the culminativity restriction. This behaviour contrasts with that of the recessive accented suffix, where the suffix accent is deleted instead. Another example of a dominant suffix is /-gúrai/ ‘at least’, which deletes the root accent to retain its own (Kawahara 2015: 468).

(6) The dominant suffix (Kawahara 2015: 468)

	root	suffixed	
a.	abura	abura-ppói	‘oily’
	kaze	kaze-ppói	‘sniffly’
b.	kíza	kiza-ppói	‘snobbish’
	adá	ada-ppói	‘coquettish’

Preaccenting suffixes comprise the third suffix class and are divided into two subtypes: dominant and recessive, represented by /-ke/ ‘family of’ and /-si/ ‘Mr.’, respectively. When combined with an accentless root, both types induce an accent on the syllable immediately preceding the suffix (7a–c). However, when combined with an accented root, only the dominant subtype induces preaccentuation (7-b), while the recessive subtype has no effect, leaving the root accent unchanged (7-d).

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[2] Verbal forms with /-tára/ attached to polysyllabic roots, e.g. *tábe-tara* ‘if he eats’, are cited in Kawahara (2015: 468) with root-final accent in the underlying representation (i.e. /tabé-tára/). This may give the impression of an accent shift to the penultimate syllable. However, no suffix-induced leftward accent shift is reported in the literature; based on standard generalisations, recessive suffixes lose their accent in the presence of a root accent and show no effect on underlying accent (Poser 1984: 66–67); (Alderete 1999: 156); (Kawahara 2015: 467). In this paper, I assume an underlying penultimate accent on verbal roots such as /tábe/, which is realised faithfully with recessive suffixes like /-tára/. This view is adopted by Trommer (2019a) and Oshima (2014: 245–246), who treat accented verbs as bearing penultimate accent across paradigms. The continuative form *tábe* ‘eat (and)’, cited by the anonymous reviewer of this paper as bearing penultimate accent, further supports the assumption of penultimate root accent.

(7) Preaccenting suffixes: dominant and recessive (Kawahara 2015: 467–470)

	root	suffixed	
a.	ono	onó-ke	‘family of Ono’
	yosida	yosidá-ke	‘family of Yoshida’
	edogawa	edogawá-ke	‘family of Edogawa’
b.	úra	urá-ke	‘family of Ura’
	múraki	murakí-ke	‘family of Muraki’
	nisímura	nisimurá-ke	‘family of Nishimura’
c.	ono	onó-si	‘Mr. Ono’
	yosida	yosidá-si	‘Mr. Yoshida’
	edogawa	edogawá-si	‘Mr. Edogawa’
d.	úra	úra-si	‘Mr. Ura’
	múraki	múraki-si	‘Mr. Muraki’
	nisímura	nisímura-si	‘Mr. Nishimura’

The usurper (i.e. deaccenting) suffixes, represented by /-kko/ ‘native of’ and /-teki/ ‘-like’, exhibit an accent-subtraction effect. These suffixes are underlyingly accentless and do not assign an accent when combined with an accentless root (8-a). However, when attached to an accented root, they delete the existing accent without contributing one of their own (8-b,c). Since the suffix itself lacks an underlying accent, this subtraction effect cannot be attributed to culminativity (as is the case with pure dominant suffixes). Other suffixes exhibiting similar subtractive behaviour in Japanese include /-iro/ ‘colour’, /-tama/ ‘ball’, and /-too/ ‘(political) party’ (Kawahara 2015: 470).

(8) Usurper suffixes (Alderete 1999: 157; Kawahara 2015: 470)

	root	suffixed	
a.	edo	edo-kko	‘native of Tokyo’
	oosaka	oosaka-kko	‘native of Osaka’
b.	kóobe	koobe-kko	‘native of Kobe’
	kyóoto	kyooto-kko	‘native of Kyoto’
c.	rónri	ronri-teki	‘logical’
	búngaku	bungaku-teki	‘literature-like’

The final suffix class comprises accent-shifting suffixes, divided into two subtypes: the attractive suffix /-mono/ ‘thing’ and the adsorbent suffix /-te/ ‘who Vs’. These suffixes are typically analysed as not bearing an underlying accent but shifting a pre-existing one; see Poser (1984: 68), Kawahara (2015: 469), and Alderete (1999: 229). That is, they do not contribute a new accent when attached to an unaccented root (9-a,c), but shift the root's underlying accent (9-b,d)[3]. The difference between the two subtypes lies in the target of the accent shift: the adsorbent attracts the root accent onto itself (9-d), whereas the attractive suffix shifts the root accent to the syllable immediately preceding the suffix—that is, the root-final syllable (9-b).

(9) Accent-shifting suffixes: attractive and adsorbent (Kawahara 2015: 469; Alderete 1999: 228)

	root	suffixed	
a.	ni	ni-mono	'cooked food'
	nori	nori-mono	'thing to ride'
b.	tabé	tabé-mono	'thing to eat'
	káki	kakí-mono	'thing to write'
c.	kiki	kiki-te	'hearer'
	katari	katari-te	'narrator'
d.	yómi	yomi-té	'reader'
	káki	kaki-té	'writer'

3 Theoretical assumptions

This study adopts a representational approach that combines two theoretical frameworks: Autosegmental Phonology (Goldsmith 1976; 1990) and Gradient Symbolic Representations (GSR) (Smolensky & Goldrick 2016; Rosen 2016). Rather than proposing new mechanisms, the aim is to explore the empirical predictions that arise from enriching autosegmental representations with gradient activity, a core assumption of GSR, originally developed to account for lexical exceptions. The key assumptions are: (i) tonal elements and TBUs are represented on separate tiers and may be either associated or floating, following Autosegmental Phonology, and (ii) phonological elements may exhibit varying degrees of activity, as formalised in GSR.

Autosegmental tonal structures are adopted here for Japanese, where a H-tone is specified for the accented TBU, namely the mora. The absence of tonal specification indicates unaccentedness. This is characteristic of privative–culminative tone systems such as Japanese, where the underlying system marks only a single position for accent (Spahr 2016; Rolle 2018), represented phonologically as a H-tone associated with a mora. The Japanese lexical accent is traditionally represented as a HL tonal complex, while the default postlexical accent is a H not followed by a L (Haraguchi 1977; Labrune 2012b; a; Kawahara 2015; Ito & Mester 2018). Although the

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[3] There is variation in the literature regarding both the status of the second vowel and the underlying accent of roots such as *káki* 'write'. I follow previous works including Kawahara (2015: 469) and Alderete (1999: 229), who present the root as bearing an underlying accent on the initial syllable, which is then shifted by accent-shifting suffixes.

L-tone is omitted from the lexical representations in this paper for readability, it is assumed to be inserted at the lexical level, as each lexical H must be followed by an L-tone. This is enforced by a constraint H→L, active at the lexical level. Toneless inputs remain toneless in this stratum and do not trigger tone insertion. At the postlexical level, a default H-tone is inserted on toneless words, but no L-tone is inserted. That is, the constraint H→L is ranked low at this stratum, and only H-epenthesis applies. The distinction between lexical and postlexical tone is thus captured by different constraint rankings across strata, as illustrated in Tableaux (10) and (11). L-tone is inserted after the lexical H at the first stratum, whereas only H is inserted on toneless words at the second stratum, and HL inputs remain unchanged[4]. Note that certain general constraints are excluded from the tableaux, such as the high-ranked Dep H in the lexical stratum, which prevents H-insertion in (10-ii), Culminativity, which penalises H-epenthesis in (11-i), and Have H, which is ranked high in the postlexical stratum and enforces a H-tone on toneless words (11-ii).

(10) Lexical stratum:

i. L-insertion after lexical H

Input: b	**H→L**	**Dep L**
☞ a. $\overset{\overset{\text{H}}{|}}{\mu}\ \overset{\overset{\text{L}}{|}}{\mu}\ \mu$		*
b. $\overset{\overset{\text{H}}{|}}{\mu}\ \mu\ \mu$	*!	

ii. No tone insertion on toneless inputs

Input: a	**H→L**	**Dep L**
☞ a. $\mu\ \mu\ \mu$		
b. $\mu\ \overset{\overset{\text{L}}{|}}{\mu}\ \mu$		*!

(11) Postlexical stratum: *i.* No tone insertion

Input: a	**Dep L**	**H→L**
☞ a. $\overset{\overset{\text{H}}{|}}{\mu}\ \overset{\overset{\text{L}}{|}}{\mu}\ \mu$		
b. $\overset{\overset{\text{H}}{|}}{\mu}\ \overset{\overset{\text{L}}{|}}{\mu}\ \overset{\overset{\text{L}}{|}}{\mu}$	*!	

ii. H-insertion on toneless inputs;
no L-insertion

Input: toneless	**Dep L**	**H→L**
☞ a. $\mu\ \overset{\overset{\text{H}}{|}}{\mu}\ \mu$		
b. $\mu\ \overset{\overset{\text{H}}{|}}{\mu}\ \overset{\overset{\text{L}}{|}}{\mu}$	*!	

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[4] The alternative proposed by the reviewer of this paper to capture the contrast between lexical HL and postlexical H is to insert the L-tone postlexically, after each lexical H, thus deriving HL contours at this later stratum. Postlexical H-tones inserted on toneless words remain a simple H and would not trigger L-insertion. However, this approach requires the grammar to distinguish between lexical and postlexical H-tones in order to restrict L-insertion to the former, which is a non-trivial distinction.

The second representational assumption adopted in this paper is GSR, under which all phonological elements can have different degrees of presence (Rosen 2016; Smolensky & Goldrick 2016; Zimmermann 2018a; 2019; Kushnir 2019). GSR is a general representational account of exceptionality in phonology that investigates how numerical gradient activity in an OT system can account for exceptional phonological behaviour. In this paper, I investigate the predictions of gradient tonal representations, specifically gradient tones and moras, in deriving the different suffix accent patterns in Japanese. I adopt a version of GSR in which underlying activity differences persist into the output. This departs from previous GSR assumptions, in which gradient activity is limited to the input and output elements are either fully present (activity = 1) or absent (activity = 0). That view assumes that GEN bans intermediate activity levels in outputs, restricting sensitivity to gradient activity to faithfulness constraints alone. More recent work, however, argues that the restriction against gradient activity in outputs should itself be treated as a violable constraint (Zimmermann 2018a; 2019). This view allows output structures to contain weakly or overly activated elements. Evidence for output gradience has been found in a range of case studies, including Welsh, Ahousaht Nuu-chah-nulth, and Moses-Columbian Salishan stress systems (Zimmermann 2018a; 2019)[5]. This study adds further support for gradient output representations, which allow markedness constraints to be violated proportionally to activity[6]. Implementation of gradient representations requires a framework in which constraints can refer to activity differences.

This study adopts Harmonic Grammar (HG; Legendre & Miyata & Smolensky 1990) in which constraints are weighted rather than ranked. Following prior work (Hsu 2022; Revithiadou & Markopoulos 2021; Müller 2019), I refer to the integration of GSR within HG as gradient HG. In gradient HG, constraint violations are proportional to the activity level of violating elements. Crucially, it is not the exact numerical value that matters, but the relative activity of competing elements. These relative differences define the thresholds for satisfying or violating markedness and faithfulness constraints. Constraint weights, in turn, reflect the relative importance of each constraint, analogous to constraint rankings in Optimality Theory (OT). The numerical values used throughout the paper are purely illustrative: they serve to highlight relative contrasts between elements and constraints, not to assign fixed quantitative meaning.

The assumptions outlined above are illustrated with a toy language where complex codas are generally tolerated (e.g. *akt*). However, exceptional morphemes exist which do not tolerate

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[5] The phonetic status of output gradience is debated (Hsu 2022). While gradient phonetic effects are well documented, e.g. in final devoicing, flapping (Bermúdez-Otero 2012), and vowel harmony (McCollum 2019), the absence of overt phonetic correlates does not preclude gradient phonological structure. As Zimmermann (2021: 28) argues, phonetic interpretation often abstracts away from certain types of phonological information.

[6] Ultimately, all gradient elements are interpreted as having default activity (1) at the phonetic level (Zimmermann 2018a).

complex codas and delete certain consonants consistently (e.g. *as* from /aks/). This morpheme-specific behaviour is captured by gradiently active consonants in the underlying structures of the morphemes: /$a_1 k_1 t_{0.5}$/ and /$a_1 k_1 s_4$/. The morpheme that exceptionally triggers simplification contains a strong consonant, resulting in highly marked structures that the grammar avoids. Crucially, the choice of which segment is deleted depends on relative activity: less active segments are more likely to be deleted. For example, in /$a_1 k_1 s_4$/, deletion of the neutrally active segment /k_1/ is preferred over deletion of the strong /s_4/, since deleting the more active segment incurs a higher cost. In contrast, /$a_1 k_1 t_{0.5}$/ does not trigger simplification, as the weak segment /$t_{0.5}$/ is tolerated in the coda. This pattern is captured using two standard constraints that are gradiently violated (adapted from Zimmermann 2018a). The constraint system reflects a general preference for preserving consonants (Max) while penalising complex codas (*CC) only in certain consonant combinations. While *CC is active, its lower weight means that it only triggers simplification when particularly strong consonants are involved. Both constraints are standard in classical OT, but they are reinterpreted here as being sensitive to gradient activity: violations are assessed in proportion to the activity level of the elements involved.

(12) a. Max: Assign violation X for any segmental activity X in the input that is not present in the output.
b. *CC: Assign violation X for every pair of adjacent consonants, where X is the sum activity of the consonants.

Computation in gradient HG involves generating output candidates from an input structure and selecting the candidate with the lowest (=best) harmony score, a numerical measure of well-formedness (Hsu 2022). As illustrated in (13), harmony scores are calculated by multiplying the numerical weight of each constraint (given below the constraint) by the number of violations incurred by a candidate. The sum of these weighted violations yields the overall harmony score for each candidate, shown in the rightmost column. The candidate with the lowest harmony score is optimal. In tableau (13), candidate (13-a) is optimal because it satisfies the high-weighted Max constraint by preserving both consonants. Its violation of *CC is relatively minor: it incurs a violation of 1.5, corresponding to the sum of the consonants' activity levels (1 + 0.5). By contrast, candidate (13-b) deletes the weak segment /t/, incurring a 0.5 violation of Max, and candidate (13-c) deletes the fully active /k/, incurring a full violation of 1. The grammar prefers preserving as much activity as possible unless the markedness cost becomes too high. When the input includes a strong consonant, as in /$a_1 k_1 s_4$/, the pressure from *CC is significantly higher, as shown in (14-c). In this case, the optimal candidate (14-a) deletes the default /k/ to avoid incurring a high markedness violation. Deletion of the strong /s/ in (14-b) is dispreferred due to the high cost incurred under Max.

(13) Consonant cluster is tolerated: $a_1k_1t_{0.5}$

	Max	***CC**	
Input: $a_1\ k_1\ t_{0.5}$	2	0.5	
☞ a. $a_1\ k_1\ t_{0.5}$		1.5	0.75
b. $a_1\ k_1$	0.5		1
c. $a_1\ t_{0.5}$	1		2

(14) The stronger consonant wins: $a_1k_1s_4 \rightarrow a_1s_4$

	Max	***CC**	
Input: $a_1\ k_1\ s_4$	2	0.5	
☞ a. $a_1\ s_4$	1		2
b. $a_1\ k_1$	4		8
c. $a_1\ k_1\ s_4$		5	2.5

As shown above, activity levels reflect phonological behaviour in a gradient system. The specific numerical values used in these examples are not essential for deriving the attested patterns. A wide range of values could produce the same results, provided that relative differences among segments are preserved. Consonants with different activity levels yield distinct thresholds for triggering phonological processes such as simplification. More concretely, in the toy language presented here, all consonants with activity levels below 2 behave similarly with respect to coda cluster simplification. As illustrated in Tableaux (15) and (16), inputs such as /$a_1k_1d_1$/ and /$a_1k_1z_{1.8}$/ are tolerated: the violations incurred by *CC are not sufficient to outweigh the higher-weighted Max constraint. Thus, consonant clusters composed of consonants whose activities fall below a threshold (e.g. 4) are preserved in the output, whereas clusters involving highly active segments surpass this threshold and trigger simplification, see (14).

(15) Consonant cluster is tolerated: /$a_1k_1d_1$/

	Max	***CC**	
Input: $a_1\ k_1\ d_1$	2	0.5	
☞ a. $a_1\ k_1\ d_1$		2	1
b. $a_1\ k_1$	1		2
c. $a_1\ t_{0.5}$	1		2

(16) Consonant cluster is tolerated: /$a_1k_1z_{1.8}$/

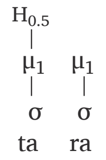
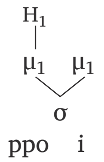
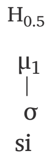
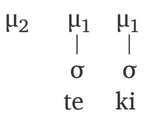
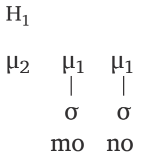
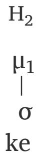
	Max	***CC**	
Input: $a_1\ k_1\ z_{1.8}$	2	0.5	
☞ a. $a_1\ k_1\ z_{1.8}$		2.8	1.4
b. $a_1\ z_{1.8}$	1		2
c. $a_1\ k_1$	1.8		3.6

HG, with its use of weighted constraints, captures gang effects. These effects arise when the cumulative influence of multiple lower-weighted constraints outweighs a single higher-weighted constraint. Such cumulative interactions are not possible in classical OT, where strict ranking prevents lower-ranked constraints from affecting the outcome. As shown in the following section, gang effects play a crucial role in accounting for the accentuation patterns induced by Japanese suffixes.

4 Gradient Harmonic Grammar analysis of suffix accentuation

Three core accentual effects can be identified in Japanese suffixes: dominance, preaccentuation, and tone shifting. The dominance effect is observed in pure dominant suffixes (e.g. /-ppói/ '-ish') and dominant preaccenting suffixes (e.g. /-ke/ 'family of'), which delete the root tone in order to realise or assign their own tone. In contrast, recessive suffixes impose their pattern only in the absence of a preexisting tone. Preaccentuation is exhibited by both dominant and recessive preaccenting suffixes (e.g. /-si/ 'Mr.'), which assign tone to the syllable immediately preceding the suffix. Other suffix types induce tone shifting: some shift an existing tone onto the suffix (e.g. the adsorbent /-te/ 'who Vs'), while others shift the tone to the presuffixal position (e.g. the attractive /-mono/ 'thing'). Some suffixes are toneless but still induce tone shifting that ultimately results in nonrealisation of tone (i.e. tone subtraction) as seen in the usurper suffix /-teki/ '-like'. In this section, I show that these diverse accentual effects follow from autosegmental representations enriched with gradient activity. This representational framework assumes that both tones and TBUs may vary along two parameters: (i) their level of activity, and (ii) their association status, i.e. whether they are underlyingly associated or floating. These two parameters predict the full range of complex accentuation patterns through independently motivated principles of tone–TBU association. The theoretical assumptions just outlined are reflected in the representations of suffix classes in (17).

(17) Underlying representations of accentual suffix classes in Japanese

i. Neutral	ii. Recessive	iii. Dominant	iv. Recessive Preaccenting
 'NOM'	 'COND'	 '-ish'	 'Mr.'
v. Usurper	**vi. Adsorbent**	**vii. Attractive**	**viii. Dominant Preaccenting**
 '-like'	 'who Vs'	 'thing'	 'family of'

Given the representational differences among suffixes, the suffix-induced patterns in Tokyo Japanese, a culminative rightmost tone system, follow from: (A) competition among H-tones and moras for association, and (B) a rightmost preference for tone realisation. Under this system, the dominance effect of a pure dominant suffix follows from the rightmost preference: the suffix has a neutrally active H_1 that competes with a root H_1 and wins by virtue of its rightmost position. The recessive class bears a weakly active $H_{0.5}$ tone, which loses to a root H_1 even when rightmost. Preaccentuation arises from a floating H sponsored by the suffix, which docks onto the root-final mora; its activity level determines its effect: $H_{0.5}$ (recessive) is overruled by the root, while H_2 (dominant) overrides it. Tone shifting is triggered by a strong mora (μ_2) in the suffix representation, which attracts the H-tone due to its higher activity. In adsorbent suffixes, this μ is underlyingly associated, drawing the tone onto the suffix. In usurper suffixes, the strong μ is floating, attracting the root H, which is ultimately not realised, resulting in subtraction. For the attractive suffix, no new mechanism is introduced. Its behaviour emerges from a combination of two representational ingredients used to model other suffix types: a floating H (as in preaccenting suffixes) and a floating strong μ (as in usurpers). This yields both deletion of the root tone (via association to the floating μ) and preaccentuation (via docking of the floating H to the root-final mora)[7].

In the following subsections, I demonstrate how these accentuation patterns are derived within HG, using standard constraints on tone–mora association from the tone literature. These include both association constraints and alignment constraints. Given the representations proposed in (17), the constraint set captures the full range of accentual behaviours exhibited by Japanese suffixes. The analysis is developed incrementally: each subsection introduces only the constraints necessary for the relevant suffix class. Full tableaux incorporating all constraints used in the analysis are provided in the appendix.

4.1 Recession

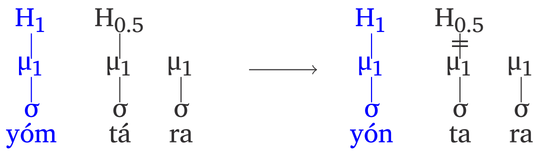
I begin with the analysis of the recessive suffix effect. The tonal representation of the suffix /tára/ ‘Conditional’ is given below. As shown, tones and moras are annotated with activity levels: the root H_1 has default activity 1, whereas the suffix $H_{0.5}$ has a lower activity of 0.5. Only the root H is realised in the output, and the suffix H becomes floating, as indicated by the crossed-out association line[8].

---

[7] The convergence of two representational ingredients for the attractive suffix, a floating strong mora and a floating H-tone, reflects the core insight of this account: attraction is analysed as the combination of preaccentuation and subtraction, without introducing any ad hoc mechanisms. This responds to concerns raised by an anonymous reviewer about arbitrariness in the representation of attractive suffixes: rather than positing a new mechanism, the analysis derives their behaviour from independently motivated elements already used for other suffix types (see Section 4.5).

[8] An inherent prediction of gradient autosegmental representations is that floating tones or moras may be gradiently active as associated ones. Gradience in GSR is assumed to apply to all structural elements in phonological representations (Hsu 2022). Activity levels have been proposed for features (Hsu 2019; Revithiadou & Markopoulos 2021; Rosen 2016), tonal autosegments (Kushnir 2019; Rosen 2019; Zimmermann 2018a), feet (Zimmermann 2018b), morphemes (Faust & Smolensky 2017), boundary symbols (Kawahara & Tanaka 2021), and even syntactic features (Müller 2019).

(18) Toned root + toned recessive suffix



The activity difference between the root and the suffix reflects their different accentual behaviours: the root H-tone with default activity overrides the weaker tone of the suffix. This follows from gradient versions of standard constraints on tone-TBU association, originally formulated as well-formedness conditions on association in Autosegmental Phonology (Goldsmith 1976). The conditions include (i) every TBU must bear a tone; (ii) every tone must be associated with a TBU; (iii) associations proceed in a one-to-one, directional manner, and (iv) association lines must not cross. As noted by Yip (2002: 83), these conditions can be reformulated in OT as violable markedness constraints: (i) *Float, (ii) Specify T, (iii) Align L/R, and (iv) *Crossing. In addition, tone is subject to general faithfulness constraints such as Dep T and Max T, which penalise tone insertion and deletion, and *Associate and *Disassociate, which penalise insertion and deletion of association lines. For clarity and consistency with recent work, I adopt simpler labels for the constraints here. For instance, *Float and Specify T, which demand association between H-tones and moras (μs), are termed H ▷ μ and μ ▷ H, respectively.

The assumption of GSR, combined with standard input–output correspondence constraints on tone, entails that constraint violations are sensitive to the activity of elements and are incurred in proportion to those activity levels. For example, H ▷ μ is violated proportionally to the activity of the H-tone, as shown in (19-b). This sensitivity to gradient activity is crucial for modelling the competition between root and suffix tones in Japanese. In combinations of a toned root and a toned recessive suffix, only one H-tone can surface, as Japanese exhibits culminativity, i.e. each prosodic word may bear at most one tone. This is enforced by the high-weighted Culm(inativity) H constraint (19-a). As a result, the two H-tones, from the root (activity 1) and the suffix (activity 0.5), compete for realisation. The outcome of this competition is determined by the constraint H ▷ μ (19-b), which favours association of the more active tone. Thus, the root H wins over the weaker suffix H. Other potential repair strategies for satisfying Culm are ruled out by other constraints. Dissociation of a tone-bearing mora is prohibited by V(owel) ▷ μ (19-c), which bans dissociation of underlyingly associated μs from the vowel. In addition, the highly weighted Max H constraint (19-d) requires that all H-tones in the input have output correspondents, banning deletion of H-tones.

(19) a. Culm(inativity) H: Assign violation 1 for every word with more than one properly integrated H-tone.

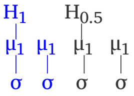
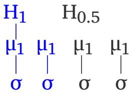
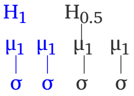
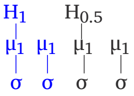
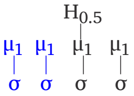
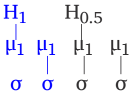
b. H ▷ μ: Assign violation X for every H-tone with activity X that is not associated to a μ.

c. V ⊳ μ: Assign violation 1 for every V-node that is not associated to a μ through an uninterrupted path of association lines.

d. Max H: Assign violation 1 for every input H-tone without a corresponding H-tone in the output.

Tableau (20) illustrates how the constraints discussed above interact to predict the tonal behaviour of a recessive suffix when combined with a toned root. The data to be analysed is *tábetara* ‘if he eats’, where the recessive suffix loses its accent to that of the root. The underlying tone of the verb root is assumed here to be penultimate, which surfaces faithfully, while the recessive suffix loses its initial tone[9]. Candidate (20-a) shows this pattern and incurs only a 0.5 violation of H ⊳ μ, compared to a full violation of 1 in candidate (20-b), making it the optimal output. Candidate (20-c) faithfully realises both H-tones and thus satisfies H ⊳ μ, but fatally violates the high-weighted Culm H. Candidate (20-d) avoids this violation by deleting the H-tone, but is ruled out by Max H, which penalises deletion of H-tones. Candidate (20-e), which dissociates the tone-bearing μ, is excluded by V ⊳ μ. The optimal strategy is therefore dissociation of one H-tone, namely the partially active suffix H. Note that certain suboptimal candidates are omitted from the tableau for brevity. For example, any candidate that changes the activity level of an element between input and output is excluded by the faithfulness constraints Dep Activity and Max Activity, which ban activity insertion or deletion.

(20) Toned root + recessive suffix: tábe-tára → tábetara ‘if he eats’

Input: 	**Max H** 200	**Culm H** 200	**V ⊳ μ** 30	**H ⊳ μ** 30	
☞ a. 				0.5	15
b. 				1	30
c. 		1			200
d. 	1				200
e. 			1		30

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[9] This paper assumes penultimate underlying tone for Japanese verbal roots, following Oshima (2014); Trommer (2019a). Further discussion of this assumption is provided in Footnote 2.

In total, the accentual recessiveness of the suffix is captured by the weak H-tone in its underlying representation, which surfaces only in the absence of a preexisting tone, but loses to the root H-tone with activity 1. This is ensured by H ⊳ μ, which favours association of the more active tone. The tone system of Japanese provides an interesting counterpoint to recession in the form of suffix dominance effects, which are addressed in the following subsections.

4.2 Dominance

Most accentual suffix types in Japanese are dominant in that they induce root tone deletion to satisfy their accentual demands. I start with the simplest dominance effect in Japanese, induced by the pure dominant suffix /ppói/ '-ish'. This suffix always realises its tone even at the cost of root tone deletion. As shown in (21), the dominant suffix is represented with a H-tone with default activity 1, which is always realised, whether combined with a toneless or a toned root.

(21) a. Toneless root + dominant suffix b. Toned root + dominant suffix

'sniffly' 'snobbish'

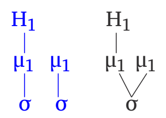
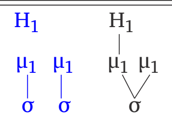
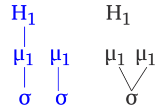
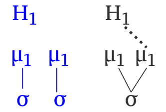
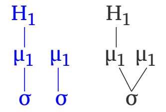
The dominant suffix is tonally stronger than the recessive (discussed above); it however, shares the same H activity as the root, as shown in (21). With a toneless root, the only H-tone in the word, that of the suffix, surfaces faithfully to satisfy H ⊳ μ as well as other faithfulness requirements such as (22-a). Once combined with a toned root, two underlying H-tones are available with the same activity, equally satisfying H ⊳ μ. However, only one tone is permitted due to the culminativity restriction. The requirement for rightmost H realisation becomes decisive and selects the suffix tone; this is captured by the Alignment constraint (22-b). ALIGNR H is 'counting cumulativity' (Jäger & Rosenbach 2006); it counts each intervening μ between the toned μ and the right edge of the word. Note that only 'properly integrated' μs (i.e. associated with σ) are taken into account, whereas the constraint could alternatively be formulated over all intervening μs, including the floating.

(22) a. DEP |: Assign violation 1 for every output association line without a correspondent input association line.

b. ALIGNR H: Assign violation 1 for every properly integrated μ that intervenes between the prosodic word's right edge and the rightmost properly integrated μ that bears a H-tone.

The constraint interactions that derive pure dominance are illustrated in tableau (23). Candidates (23-a,b) are equally harmonic with respect to H ⊳ μ; however, (23-a), which maintains the suffix H, minimally violates AlignR H and therefore outweighs (23-b). (23-c) perfectly satisfies this constraint, but is nevertheless excluded by the higher-weighted Dep |; this shows that a minimal violation of AlignR H is tolerated to satisfy Dep |. The faithful realisation of both H-tones in (23-d) is also excluded by the high-weighted Culm H.

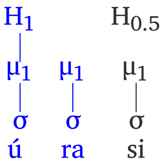
(23) Pure dominance effect: kíza-ppói → kizappói ‘snobbish’

Input:		**Culm H** **200**	**H ⊳ μ** **30**	**Dep |** **7**	**AlignR H** **0.5**	
☞ a.			1		1	30.5
b.			1		3	31.5
c.			1	1		37
d.		1			4	202

4.3 Preaccentuation

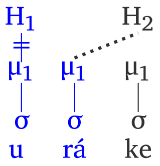
Preaccenting suffixes do not surface with a tone themselves but assign a H-tone to the final syllable of the root. This effect comes in two types: dominant and recessive. Dominant suffixes always impose preaccentuation, whereas recessive suffixes do so only in the absence of a preexisting tone. The suffixes /-ke/ ‘family of’ and /-si/ ‘Mr.’ exemplify the dominant and recessive subtypes, respectively. The analysis proposed here departs from earlier accounts in that it does not attribute the dominant/recessive distinction to different phonologies or diacritic markings (see Section 5.1 for discussion of preaccentuation in the TAF account of Alderete 1999). Instead, this distinction follows from the principles underlying gradient autosegmental representations. Preaccentuation is analysed here as triggered by a floating H-tone in the suffix’s representation. The H-tone is not underlyingly associated to any mora, but may dock onto a root mora. Dominant suffixes have stronger tone assignment requirements than recessive ones. This is represented in (24) by the difference in activity levels of the suffixes' H-tones: the dominant suffix has a strong H with activity 2 (24-b) while the recessive suffix has a weak H with activity 0.5 (24-a).

(24) a. Recessive preaccentuation



'Mr. Ura'

b. Dominant preaccentuation



'family of Ura'

The association of the floating H to a mora is governed by the derived environment restriction proposed by Van Oostendorp (2007), formalised as the constraint ALTERNATION (25). This constraint penalises epenthetic associations between tautomorphemic elements, thereby triggering the association of a floating tone to a mora belonging to a morpheme other than the one that sponsors the tone[10]. This constraint has been employed in analyses of various tonal processes involving floating tone associations across morpheme or word boundaries (see, e.g. Trommer 2022).

(25) ALT(ERNATION): Assign violation 1 for every epenthetic association line between tautomorphemic elements.

Tableau (26) illustrates the role of ALTERNATION in deriving dominant preaccentuation. Candidate (26-a) emerges as optimal: $H \triangleright \mu$, ALIGNR H, and ALTERNATION jointly favour association of the strong H-tone to the rightmost heteromorphemic μ. In candidate (26-b), the suffix docks its floating H-tone to its own μ, violating ALTERNATION, which penalises such tautomorphemic associations. The floating H-tone must therefore associate with the root instead, where ALIGN-R H determines its docking site: it attaches to the rightmost root μ (26-a), since additional violations of this constraint are not tolerated (26-c). The gradiently evaluated constraint $H \triangleright \mu$ induces the dominance effect: associating the suffix's strong floating H

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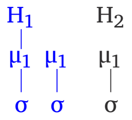
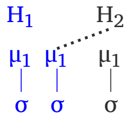
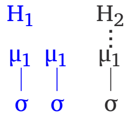
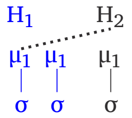
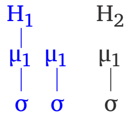
[10] The original definition of ALTERNATION (i), given in Van Oostendorp (2007), relies on the notion of morphological colour. In this approach, phonological elements and association lines are assigned arbitrary colours, as the minimal morphological information.

(i) ALTERNATION: If an association line links two elements of colour α, the line should also have colour α.

Under this view, if an association line is underlying, it has the colour of the morpheme to which it belongs; if epenthetic, it lacks a colour. The constraint is thus violated when two elements of the same morpheme are linked by a colourless line.

(activity 2) incurs less cost than faithfully realising the root H (activity 1) (26-d). This asymmetry is reflected in the weighting relation H ⊳ μ > Dep |[11]. Finally, faithful realisation of both the root and suffix H would best satisfy H ⊳ μ, but this candidate is excluded by the high-weighted Culm H.

(26) Dominant preaccentuation: úra-ke → uráke 'family of Ura'

Input:		**H ⊳ μ** **30**	**Dep |** **7**	**Alt** **4**	**AlignR H** **0.5**	
☞ a.		1	1		1	37.5
b.		1	1	1		41
c.		1	1		2	38
d.		2			2	61

The situation differs in the case of the recessive preaccenting suffix. This class does not exert a strong enough demand for H-tone assignment to override the root's H-tone. This is captured by the suffix's weak H with an activity level of only 0.5 and by the constraint H ⊳ μ, which favours the faithful realisation of the root H with default activity. This is illustrated in (27-a), where the root H is merely penalised by Align-R H, a constraint whose weight is too low to be decisive in this context. In contrast, candidate (27-b), which dissociates the root H, not only incurs a greater violation of H ⊳ μ (by 0.5) but also violates Dep | due to the insertion of a new association line. It is thus apparent that only in the absence of a root tone does the suffix's H-tone associate optimally. Since this outcome is analytically straightforward and less informative than other, more complex patterns, it is not discussed in detail here (see tableau 61 in Appendix).

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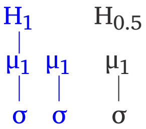
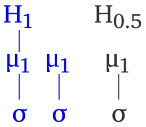
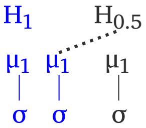
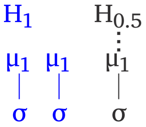
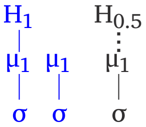
[11] Docking of the strong floating H on the root is driven here by the joint effect of the high-weighted constraints Max H and H ⊳ μ. Earlier work has proposed alternative constraints, such as Max Float and *Float, to model similar effects (Wolf 2005).

(27) Recessive preaccentuation: úra-si → úrasi ‘Mr. Ura’

Input:		**CULM H** **200**	**H ▷ μ** **30**	**DEP |** **7**	**ALT** **4**	**ALIGNR H** **0.5**	
☞ a.			0.5			2	16
b.			1	1		1	37.5
c.			1	1	1		41
d.		1		1	1	2	212

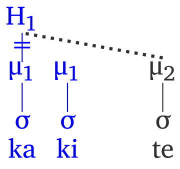
As shown above, the preaccentuation effect arises from the integration of the floating H-tone, whose association is restricted to a derived environment. The locality of preaccentuation, i.e. the tone surfacing adjacent to the sponsoring suffix, results from the rightmost alignment requirement, rather than from any intrinsic structural adjacency; cf. the morpheme-contiguity assumption proposed in alternative analyses of preaccentuation (Revithiadou 2007; Kurisu 2001). See Section 5.4 for further discussion of this assumption.

4.4 Subtraction

Three accentual suffix classes in Japanese, the adsorbent, the usurper, and the attractive, exhibit non-replacive dominance, analysed here as tone subtraction. All three classes eliminate the root’s H-tone when one is present, yet show no tonal effect when attached to a toneless root. This shared subtractive behaviour, which unifies these suffix classes, poses analytical challenges. I reserve discussion of the attractive class for the next subsection, as it involves a combination of subtraction and preaccentuation, and thus merits separate treatment. This section focuses on two suffix types: (i) the adsorbent suffix, represented by /-te/ ‘who Vs’, which removes the root H-tone and surfaces with that tone itself, but remains toneless when attached to a toneless root; and (ii) the usurper suffix, represented by /-teki/ '-like', which deletes the root H-tone and renders the entire word toneless, while having no effect on toneless roots. In both cases, the culminativity restriction is orthogonal to the deletion effect, since the suffixes themselves are underlyingly toneless. Dominance is therefore not due to the insertion of a competing H-tone. Root tone deletion cannot be attributed to a preassociated dominant H-tone (as in the pure dominant class; Section 4.2) or to an overriding strong floating H-tone (as in the preaccenting class; Section 4.3). Below, I show that the subtractive patterns follow from a representational analysis that uses the same general mechanism responsible for replacive dominance discussed earlier, namely a preference for association with more active elements, whether tones or moras.

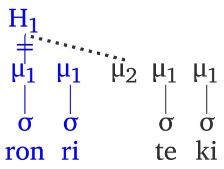
Gradient autosegmental representations allow phonological elements to differ in activity not only on the tonal tier, but also on the moraic tier. Under this assumption, tone subtraction follows from a suffix's strong requirement to bear a H-tone. In the case of the adsorbent suffix /-te/ 'who Vs' and the usurper suffix /-teki/ '-like', both are analysed as underlyingly toneless, but as strongly requiring a tone. This requirement is encoded in their representation as a highly active mora (μ_2) that is not linked to a H-tone and demands one. This shared representational ingredient unifies the two suffix classes and distinguishes them from other suffix types. The difference between the two suffix classes lies in the association status of this strong mora: in the adsorbent class, it is underlyingly associated (28-a), whereas in the usurper class it is floating (28-b).

(28) a. Toned root + adsorbent suffix



'writer'

b. Toned root + usurper suffix



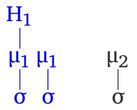
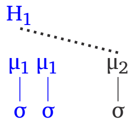
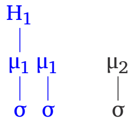
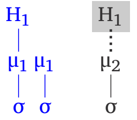
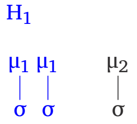
'logical'

Capturing the tone attraction effect of the strong μ requires a constraint sensitive to moraic activity, namely the gradiently violated constraint $\mu \triangleright H$ in (29) (the reverse counterpart of $H \triangleright \mu$). It requires every mora to be associated with a H-tone and evaluates violations proportionally to moraic activity, thereby favouring association of more active moras to tone.

(29) $\mu \triangleright H$: Assign violation X for every μ with activity X that is not associated to a H-tone.

Tableau (30) illustrates the role of $\mu \triangleright H$ in enforcing root H deletion with the adsorbent suffix. In the optimal candidate (30-a), the root's underlying H-tone dissociates and reassociates with the suffix's strong mora. This reassociation incurs a Dep | violation, but this is tolerated since it avoids a more costly violation of the gradient constraint $\mu \triangleright H$, as shown in (30-b). This trade-off reflects the weighting relation $\mu \triangleright H >$ Dep |. In contrast, candidate (30-c) incurs a fatal violation of Culm by maintaining the root H and inserting an additional H-tone (highlighted in the tableau) on the strong suffix mora in order to satisfy μ ▷ H. This strategy is also ruled out by a high-weighted Dep H (not shown in the tableau), which penalises tone insertion. This constraint is also operative for the adsorbent suffix's interaction with toneless roots, as in /kiki-te/ → kikite 'narrator' (Poser 1984). The relevant representation (28-a) and the constraints in (30) derive this outcome straightforwardly: the high-weighted Dep H ensures that no H-tone is inserted, even on strong moras. However, when a H-tone is available in the input, it is reassigned to the suffix's strong mora, since Dep | is not strong enough. The crucial asymmetry between toned and toneless roots is therefore captured by the weighting Dep H > Dep |, which explains both the suffix's dominance effect in the presence of a root tone and its lack of effect when attached to a toneless root.

(30) Tone adsorption: káki-te → kakité 'writer'

Input:		**Culm H** **200**	**μ ▷ H** **30**	**H ▷ μ** **30**	**Dep |** **7**	**Alt** **4**	**AlignR H** **0.5**	
☞ a.			2		1			67
b.			3				2	91
c.		1	1		1		2	238
d.			4	1				150

The usurper suffix, represented by /-teki/ '-like', is the second subtractive suffix addressed in this subsection. Like the adsorbent suffix, it has no effect on a toneless root, yet deletes the root's H-tone. However, it does not surface with a H-tone itself. The same set of constraints used above derives this subtractive effect, although the surface result differs. Here, the root H is usurped by the suffix but not realised overtly (cf. the adsorbent suffix)[12]. I analyse this usurpation effect as

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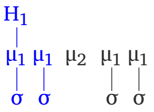
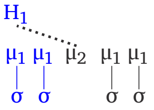
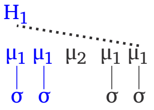
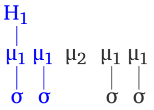
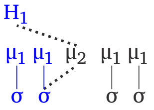
[12] The term usurpation and its underlying logic are adopted from Zimmermann's (2013) mora-usurpation analysis of vowel deletion, in which a mora-less vowel in a suffix associates to the mora of a host vowel, resulting in deletion of the latter.

arising from the underlying representation of the suffix, specifically from a floating strong mora that lacks a H-tone but strongly demands one. As shown in Tableau (31), the optimal candidate (31-a) associates its floating strong μ with the only available H-tone, namely the root H, thus optimally satisfying μ ⊳ H. This is the same mechanism seen in the adsorbent case, cf. candidate (30-a). However, in the usurper suffix, the strong μ is floating and remains so due to the high-weight constraint Dep | μ-S (see (31-d)). This constraint bans the insertion of a new association between a mora and a segment, ensuring that the floating μ does not trigger vowel lengthening or shortening[13]. In candidate (31-b), the root H associates with the rightmost integrated μ, satisfying AlignR H, but this candidate is suboptimal because the high activity of the floating strong μ and the weight of μ ⊳ H jointly favour association with the suffix μ. The faithful realisation of the root H, as seen in (31-c), also fails as it results in an additional violation of μ ⊳ H by the floating strong μ. The output is a toneless word, as the H-tone cannot be realised on any of the integrated μs, which are less active than the suffix floating μ. The H-tone is instead associated with the strong floating μ in (31-a), although this association is not phonetically realised due to its non-integration into the prosodic structure. Finally, note that the non-association of the floating μ does not trigger a violation of V ⊳ μ. This constraint penalises newly floating moras, that is, moras that have been dissociated in the output; the strong μ in this case is underlyingly floating.

(31) Tone usurpation: rónri-teki → ronriteki ‘logical’

Input:		Dep | μ-S	V ⊳ μ	μ ⊳ H	Dep |	AlignR H	
		200	95	30	7	0.5	
☞ a.				4	1		127
b.				5	1		157
c.				5		3	151.5
d.		1		4	2	2	335

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[13] Floating moras are used for various effects across languages. For instance, pre-lengthening in Hausa is derived from a floating mora (Newman 1995), and subtractive morphology has been analysed as a side-effect of floating mora suffixation (Trommer & Zimmermann 2014). It is worth noting that none of the suffixes in Japanese induce vowel lengthening, with the exception of the plural /-zu/, which has been argued to trigger lexically conditioned lengthening inconsistently (Kawahara 2015).

The final interaction I briefly address is the suffix's lack of effect on a toneless root, as in /bungaku-teki/ → *bungakuteki* 'literature-like'. This case is not illustrated with a tableau, as it follows straightforwardly: due to the high weight of DEP H, all μs, including the strong floating μ, remain toneless in the absence of a preexisting H-tone. The apparent contrast between dominance and neutrality is resolved by the weighting of the two DEP constraints. Specifically, the suffix is strong enough to override DEP | and usurp an existing H-tone under the pressure of μ ⊳ H, but not strong enough to override DEP H and trigger tone insertion.

4.5 Attraction

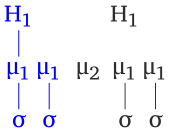
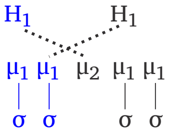
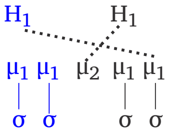
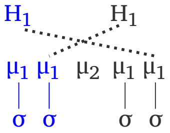
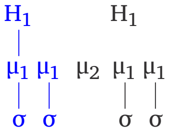
The final suffix class is the attractive class, exemplified by /-mono/ '-like'. Attraction is a codependent effect: the surface pattern depends crucially on the interaction between the suffix and the root. The suffix has no effect when attached to a toneless root; however, when a root H-tone is present, it induces tone shift, analysed here as the combination of preaccentuation and usurpation. The pattern follows directly from combining the representational ingredients proposed for these two phenomena: a floating strong μ, responsible for usurpation, and a floating H, responsible for preaccentuation, as illustrated in (32). When a toned root is present, the floating H and the floating strong μ associate heteromorphemically. The strong floating μ attracts the root H, resulting in root tone deletion, while the floating H docks onto the root-final mora, yielding preaccentuation. The overall effect is apparent attraction of tone towards the suffix (32-a). When the root is toneless, the floating elements associate tautomorphemically. They crucially do not integrate into the prosodic structure, yielding no surface H-tone and no accentual effect (32-b).

(32) a. Toned root + attractive suffix b. Toneless + attractive suffix

'thing to write' 'cooked food'

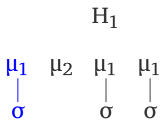
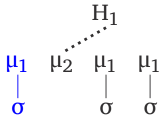
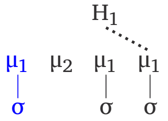
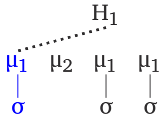
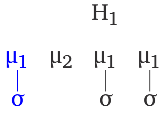
Tableau (33) illustrates the interaction of constraints in deriving the tone shift in a toned root followed by an attractive suffix. The crucial constraint set H ⊳ μ and μ ⊳ H sets two core requirements in this context: (i) both H-tones (whether underlyingly associated or floating) must be hosted by a mora, and (ii) the stronger μ must be associated with a H-tone. Both of these conditions are satisfied by the close contenders (33-a) and (33-b): in each, the strong μ bears a H-tone, and the floating H-tone is associated with a mora. The decision between these candidates is determined by the constraint ALTERNATION. Candidate (33-b) performs better on ALIGNR H, as it realises the root H on the rightmost available mora. However, to satisfy μ ⊳ H, it must associate the remaining H-tone to the tautomorphemic strong μ, thereby violating Alternation, which is weighted higher than AlignR H. This renders (33-a) optimal. Other candidates that might satisfy both μ ⊳ H and H ⊳ μ are not shown, as they incur fatal violations of Alternation. For the remaining candidates (33-c) and (33-d), the exclusion is straightforward: both fail to associate a H-tone to the strong μ, resulting in severe violations of μ ⊳ H. Realisation of both H-tones is independently excluded by the high-weighted constraint Culm H, omitted from the tableau for space reasons. Regarding the crossing association lines in the optimal candidate (33-a), note that the root H associates to the suffix strong μ, which remains floating and does not integrate into the prosodic structure. This suggests that the ban on crossing lines, enforced by a high-weighted constraint, is violated only when the crossing involves integrated elements.

(33) Tone attraction: káki-mono → kakímono ‘thing to write’

Input: 	**μ ⊳ H** **30**	**H ⊳ μ** **30**	**Dep |** **7**	**Alt** **4**	**AlR H** **0.5**	
☞ a. 	3		2		2	105
b. 	3		2	1		108
c. 	4		2		2	135
d. 	5	1			3	181.5

When the attractive suffix is concatenated with a toneless root, the output remains toneless; that is, the suffix has no surface effect. The question is how the grammar resolves the association of the floating H-tone and the strong μ, which ideally should satisfy both H ⊳ μ and μ ⊳ H. This interaction is illustrated in Tableau (34). In candidate (34-d), both elements remain unassociated, incurring fatal violations of the two high-weighted gradient constraints, despite perfect satisfaction of the lower-weighted constraints. Given the high activity of the suffixal μ, associating the floating H-tone with any μ of default activity, as in (34-b) and (34-c), results in a more serious violation of μ ▷ H. Consequently, in the absence of a root H, tautomorphemic association between the suffix's strong μ and its floating H yields the most harmonic outcome, as shown in (34-a). Although this candidate violates ALTERNATION, the violation is tolerated because it minimises the overall harmony score by satisfying the more highly weighted constraint μ ▷ H.

(34) No surface effect: ni-mono → nimono 'cooked food'

Input: 	**μ ▷ H** **30**	**H ▷ μ** **30**	**DEP |** **7**	**ALT** **4**	**ALIGNR H** **0.5**	
☞ a. 	3		1	1		101
b. 	4		1	1		131
c. 	4		1		2	128
d. 	5	1				180

5 Alternative accounts of Japanese suffix accentuation

This section reviews several alternative accounts. Section 5.1 discusses the Transderivational Antifaithfulness account of Alderete (1999). Section 5.2 turns to the gradient HG account of Revithiadou (2023). The two-dimensional concatenation proposal of Trommer (2019a) is addressed in Section 5.3, followed by a brief review of Realise Morpheme Theory proposed by Kurisu (2001) in Section 5.4.

5.1 Transderivational Antifaithfulness Theory (Alderete 1999)

Alderete (1999) develops Transderivational Antifaithfulness Theory (= TAF) by building on Benua (1997) to account for non-concatenative morphology and affix-controlled accentual phenomena, including dominance effects in Japanese. This section shows that the TAF account runs in a ranking paradox in addition to theoretical complications.

A key assumption of TAF is root-controlled accentuation, whereby the root's accentual demand necessarily overrides that of the suffix. To account for cases of affix dominance, the theory proposes a new constraint family, namely antifaithfulness constraints. These constraints include a negative version of faithfulness constraints each of which demands unfaithfulness with respect to a particular phonological feature in a derivative with respect to its base. For example, ¬OO-Max-Prom demands deletion of accent, ¬OO-Dep-Prom mandates insertion of accent not present in the base, and ¬OO-Flop-Prom requires shifting of base accent. TAF constraints hence demand a change in the base of affixation. Crucially, however, the ultimate realisation of this change is governed by the language's general grammar. Within this account, each dominant affix subcategorises for an antifaithfulness constraint. Thse assumptions are applied to Japanese suffix classes and illustrated below. The pure dominant suffix /ppói/ '-ish' is assumed to subcategorise for ¬OO$_{\text{DOM}}$-Max(Accent) that outranks its faithfulness counterpart Max(Accent). The AF constraint is also ranked higher than the antifaithfulness constraint indexed to the recessive suffix /tára/ 'Cond. This is shown in the schematic ranking (35).

(35) Dominance and recession distinction (Alderete 1999: 159)
¬OO$_{\text{DOM}}$-Max(Accent) > OO-Max(Accent) > ¬OO$_{\text{REC}}$-Max(Accent)

(36) illustrates the ranking of TAF and faithfulness constraints in deriving the different behaviours of the pure dominant and the recessive suffix. The dominant suffix subcategorises for ¬OO$_{\text{DOM}}$-Max(Ac) that outranks OO-Max(Ac) and induces root accent deletion (36-ib). The opposite ranking with ¬OO$_{\text{REC}}$-Max(Ac) that is activated by the recessive suffix results in root dominance (36-iib). As shown by the shadings, the TAF constraints are only sensitive to the affixes that trigger them.

(36) Dominance vs. recession: -ppói '-ish' vs. -tára 'Cond' (Alderete 1999; 2001)

i. Base = /adá-ppói/	¬OO$_{\text{DOM}}$-Max(Ac)	OO-Max(Ac)	¬OO$_{\text{REC}}$-Max(Ac)	IO-Max(Ac)
a. adá-ppoi	*!		▨	*
☞ b. ada-ppói		*	▨	*
Input = /yóm-tára/	¬OO$_{\text{DOM}}$-Max(Ac)	OO-Max(Ac)	¬OO$_{\text{REC}}$-Max(Ac)	IO-Max(Ac)
a. yon-dára	▨	*!		*
☞ b. yón-dara	▨		*	*

The next suffix class to be discussed is the usurper /-kko/ 'native of'. Recall from Section 4.4, that this suffix is accentless but deletes the root accent, hence the word is rendered accentless.

The suffix has no effect on an accentless root. In the tableau below, (37-i) shows how ¬OO$_{\text{DOM}}$-Max(Ac) subcategorised by the suffix captures its subtraction effect. The TAF constraint is responsible for the root's accent deletion and excluding the faithful candidate (37-ia). A high-ranked general faithfulness constraint, namely IO-Dep(Ac), is required to exclude accent insertion on the root or the suffix (37-ib), ensuring the word's unaccentedness (37-ic). Alderete (1999: 223–24) asserts that a new TAF constraint is required to derive the peculiar effect of the other subtractive suffix, namely the adsorbent /-te/ 'who'. Recall that this suffix has no effect on an accentless root but induces root accent deletion. However, unlike the usurper, it bears the surface accent itself. This difference requires the root faithfulness constraint IO-Max(Ac)$_{\text{ROOT}}$ that is ranked high in the grammar of the adsorbent but is crucially ranked below the TAF constraint of the usurper (¬OO$_{\text{US}}$-Max(Ac)). This is shown in (37-ii) where the root faithfulness constraint is lower than the usurper's TAF constraint but not strictly ranked with respect to ¬OO$_{\text{ADS}}$-Max(Ac). (37-iia) shows how the TAF constraint enforces deletion of the root accent. The optimal candidate (37-iic) shows that IO-Max(Ac)$_{\text{ROOT}}$ is crucial to ensure the surfacing of the underlying accent on the suffix by excluding the complete deletion of accent (37-iib).

(37) Usurpation vs. adsorption: -kko '-native of' vs. -te 'who' (Alderete 1999; 2001)

i. Base = kóobe 'Kobe' Input = /kóobe-kko/	¬OO$_{\text{DOM}}$-Max(Ac)	IO-Dep(Ac)	¬OO$_{\text{ADS}}$-Max(Ac)	IO-Max(Ac)$_{\text{ROOT}}$
a. kóobe-kko	*!			
b. koobé-kko		*!		
☞ c. koobe-kko				*
ii. Base = káku 'write' Input = /káki-te/	¬OO$_{\text{DOM}}$-Max(Ac)	IO-Dep(Ac)	¬OO$_{\text{ADS}}$-Max(Ac)	IO-Max(Ac)$_{\text{ROOT}}$
a. káki-te			*!	
b. kaki-te				*!
☞ c. kaki-té				

The TAF treatment of preaccentuation requires more complex mechanisms, namely the local conjunction of TAF constraints with anchoring constraints. (38) is proposed by Alderete (1999: 201) that is a conjunction of ¬OO-Dep(Accent) with the already conjoined constraint Anchor-R/L. The constraint prohibits the preaccenting suffix from de-aligning the stem through suffixation and at the same time triggers an epenthetic accent onto the stem at the de-aligned edge.

(38) ¬OO-Dep(Ac)$_{\text{EDGE-}\sigma}$ (¬OO-Dep(Ac) & Anchor-R/L(Stem, PW)$_{\sigma}$):
In base-derivative pairs, an accent that is not present in the base must be inserted in the derived form in the syllable which is de-aligned through affixation.

Tableau (39) illustrates the effect of this rather complex constraint in deriving dominant and recessive preaccentuation. The dominant suffix /-ke/ ‘family of’ subcategorises for ¬OO$_{\text{DomPre}}$-Dep(Ac)$_{\text{EDGE-}\sigma}$ that outranks the faithfulness constraints and induces accent assignment to an adjacent position to the preaccenting suffix; this is shown in (39-ib) that is chosen over (39-ia) that maintains the root accent. The opposite ranking of IO-Max(Ac)$_{\text{ROOT}}$ and ¬OO$_{\text{RecPre}}$-Dep(Ac)$_{\text{EDGE-}\sigma}$ activated by recessive preaccenting suffix (/-si/ ‘Mr.’) results in preservation of the root accent (39-iib). The suffix only induces preaccentuation on an accentless root which is captured by the TAF constraint outranking IO-Dep(Ac)$_{\text{ROOT}}$ (39-iid).

(39) Dominant vs. recessive preaccentuation: -ke ‘family of’ vs. -si ‘Mr.’ (Alderete 1999: 207)

i. Base = nisímura Input = /nisímura-ke/	¬OO$_{\text{DomPre}}$-Dep(Ac)$_{\text{EDGE-}\sigma}$	IO-Max(Ac)$_{\text{ROOT}}$	¬OO$_{\text{RecPre}}$-Dep(Ac)$_{\text{EDGE-}\sigma}$	IO-Dep(Ac)$_{\text{ROOT}}$
a. nisímura-ke	*!			
☞ b. nisimurá-ke		*		*
ii. Base = nisímura Input = /nisímura-si/	¬OO$_{\text{DomPre}}$-Dep(Ac)$_{\text{EDGE-}\sigma}$	IO-Max(Ac)$_{\text{ROOT}}$	¬OO$_{\text{RecPre}}$-Dep(Ac)$_{\text{EDGE-}\sigma}$	IO-Dep(Ac)$_{\text{ROOT}}$
a. nisimurá-si		*!		*
☞ b. nisímura-si			*	
Base = yosida Input = /yosida-si/	¬OO$_{\text{DomPre}}$-Dep(Ac)$_{\text{EDGE-}\sigma}$	IO-Max(Ac)$_{\text{ROOT}}$	¬OO$_{\text{RecPre}}$-Dep(Ac)$_{\text{EDGE-}\sigma}$	IO-Dep(Ac)$_{\text{ROOT}}$
c. yosida-si			*!	
☞ d. yosidá-si				*

A brief look at the summary rankings proposed by Alderete (1999) reveals a ranking paradox. The crucial constraints involved are the faithfulness constraints IO-Dep(Ac) and IO-Max(Ac) (highlighted in red). Although two versions of each constraint are posited, one general and one local root-restricted, they stand in a subset relation, giving rise to a ranking paradox. For instance, in (40-b), the general IO-Dep(Ac) must be dominated by IO-Max(Ac)$_{\text{ROOT}}$ to permit recessive preaccenting suffixes to assign accent to an accentless root. However, in (40-c), the reverse ranking is required: IO-Dep(Ac) must dominate IO-Max(Ac)$_{\text{ROOT}}$ to derive accent usurpation. One possible workaround would be to allow IO-faithfulness constraints to be lexically subcategorised by suffixes. However, this move is not entertained in Alderete (1999), which explicitly restricts lexical subcategorisation to TAF constraints.

(40) Summary Rankings for suffix and compound accentuation (Alderete 1999: 204–207 + 230–234)

a. Dominance vs. recession suffixes: -ppói '-ish' vs. -tára 'cond'
$\neg\mathrm{OO}_{\mathrm{DOM}}$-Max(Ac) > OO-Max(Ac) > $\neg\mathrm{OO}_{\mathrm{REC}}$-Max(Ac) > IO-Max(Ac)

b. Dominant vs. recessive preaccentuation: -ke 'family of' vs. -si 'Mr.'
$\neg\mathrm{OO}_{\mathrm{DOMPRE}}$-Dep(Ac)$_{\mathrm{EDGE}\text{-}\sigma}$ > IO-Max(Ac)$_{\mathrm{ROOT}}$ > $\neg\mathrm{OO}_{\mathrm{RECPRE}}$-Dep(Ac)$_{\mathrm{EDGE}\text{-}\sigma}$ > IO-Dep(Ac)$_{\mathrm{Root}}$

c. Usurpation vs. adsorption: -kko vs. -te 'who Vs'
$\neg\mathrm{OO}_{\mathrm{DOM}}$-Max(Ac), IO-Dep(Ac) > IO-Max(Ac)$_{\mathrm{ROOT}}$, $\neg\mathrm{OO}_{\mathrm{ADS}}$-Max(Ac) > OO-Max(Ac) > $\neg\mathrm{OO}_{\mathrm{REC}}$-Max(Ac)

5.2 Gradient HG account (Revithiadou 2023)

Revithiadou (2023) offers a GHG account of dominance effects centred on so-called dependent accents: accents that surface only if at least one underlying accent is present elsewhere in the word. In Japanese, attractive and adsorbent suffixes are considered dependent, as they show co-dependency with the roots in determining the accent pattern of the word. Revithiadou's account builds on two core ingredients: (i) autosegmental representations in which accent is modelled as a prosodic root node π (following Spahr 2016), and (ii) constraint indexation, formalised as a scaling factor s introduced by affixation (Gouskova & Linzen 2015), which increases the penalty of indexed constraints. Dominance is modelled as a violation of the scaled constraint, multiplied by both the constraint's weight and the affix-induced scaling factor, i.e. $-n \times w \times s$, (see Mcpherson & Hayes 2016). Revithiadou (2023) illustrates the account by a case study of Lithuanian accent, where dominant suffixes are associated with $s = 2$, so deletion of their accent doubles the penalty of Max[π], which penalises deletion of a prosodic root node π in proportion to its activity. Non-dominant suffixes have $s = 1$ and exert no scaling effect on constraint evaluation. To account for morpheme codependency in accentuation, each morpheme bears a latent weak accent with activity 0.5. On its own, such an accent remains unrealised, due to Dep[π] that penalises activity insertion and crucially outweighs Max[π]. Weak accents can only surface when their activities merge into a stronger π-node, following the mechanism proposed in Kushnir (2019).

Although Revithiadou (2023) focuses on Lithuanian accentuation, the account is claimed to extend to Japanese, for which a brief sketch is provided here. As mentioned above, central to the proposal is a scalar constraint Max[π], which penalises deletion of the prosodic root node (π) proportionally to its activity and a scaling factor s introduced by dominant suffixes[14]. Codependency effects observed in attractive and adsorbent suffixes are accounted

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[14] It is not clear whether, for Revithiadou (2023), scaling is restricted to 'derivational' suffixes, as in the head-dominance effect proposed in Revithiadou (1999). If so, the existence of 'inflectional' dominant suffixes poses a major challenge. This issue is set aside here and scaling is taken to apply to all affix types.

for by the weighting relation DEP[π] $>$MAX[π], which blocks the realisation of weak accents unless they are coalesced. To see the predictions of this account for Japanese, I construct an analysis based on the core assumptions outlined in Revithiadou (2023)[15]. Since output gradience is not permitted in her account, it is avoided here. Scaling is likewise not applied, to allow a fair comparison with the present account—particularly as the aim is to evaluate whether an input-only gradient approach can capture Japanese suffix accent patterns using only general constraints.

The gradient representations in (41) are proposed for suffix classes in which the accent (π) exhibits gradient activity at or below 1, following the input-only gradient approach of Revithiadou (2023). Accents may be either associated or floating. All roots are assumed to bear a weakly active associated accent with activity 0.5, enabling the accent coalescence mechanism to derive the codependency effects.

(41) Underlying representations of Japanese suffix classes (based on Revithiadou 2023)

i. Neutral	ii. Recessive	iii. Dominant	iv. Recessive Preaccenting
$\begin{array}{c} \\ \\ x\end{array}$	$\begin{array}{c}\pi_{0.9}\\ \vert\\ x\end{array}$	$\begin{array}{c}\pi_{1}\\ \vert\\ x\end{array}$	$\begin{array}{c}\pi_{0.6}\\ \\ x\end{array}$
v. Usurper	vi. Attractive	vii. Adsorbent	viii. Dominant Preaccenting
$\begin{array}{c}\pi_{0.1}\\ \vert\\ x\end{array}$	$\begin{array}{c}\pi_{0.5}\\ \\ x\end{array}$	$\begin{array}{c}\pi_{0.5}\\ \vert\\ x\end{array}$	$\begin{array}{c}\pi_{0.9}\\ \\ x\end{array}$

I adopt the constraints in (42), following Revithiadou (2023). DEP[π] and MAX[π] are crucially sensitive to the activity level of accents, and RIGHTMOST[π] is gradient, assigning penalties based on the number of moras between the π-node and the right edge of the word.

(42) a. DEP[π]: Any amount of activity of the autosegmental π-node in the output has a correspondent amount of underlying activity.

b. MAX[π]: Any amount of underlying activity of the autosegmental π-node has a correspondent amount of activity in the output.

c. R(IGHT)M(OST)[π]: Align the π-node with the right edge of the phonological word.

d. UNIF(ORMITY)[π]: No π-node in the output has multiple correspondents in the input.

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[15] This account is a reconstruction based on the core assumptions in Revithiadou (2023), which sketches a possible extension to Japanese without offering a full analysis. The version presented here constitutes one possible implementation of the coalescence and deletion mechanisms proposed for Lithuanian.

Tableau (43) illustrates how the constraints interact to capture the accentual behaviour of the adsorbent suffix /-te/ ‘agentive’, which surfaces with an accent only when the root is underlyingly accented. Both the root and suffix bear weak accents ($\pi_{0.5}$), which coalesce into a single accent with activity 1 under the weighting DEP[π] > MAX[π] (43-a). Compare (43-c), which inserts activity on the root accent and deletes the suffix accent. Candidate (43-b), which realises the merged accent on the leftmost mora, is ruled out by RM[π]. Finally, the unaccented candidate (43-d) is excluded by MAX[π], which is violated by the combined activity of root and suffix (0.5 + 0.5 = 1). The same mechanism accounts for attractive suffixes, represented with a floating weak accent ($\pi_{0.5}$). As shown in (44-a), merging the accents and realising them on the rightmost root syllable is preferred over alternatives such as leftmost accentuation (44-b), ruled out by the gradient RM[π], or accent deletion (44-c,d). A crucial candidate not included in the tableau is one where the merged accent surfaces on the suffix; this is ruled out by the constraint ALTERNATION (introduced in (25), Section 4.3), which bans epenthetic association of a floating accent with its sponsor. When the adsorbent or attractive suffix combines with an accentless root, the optimal output is an unaccented form. The suffix’s weak accent is not realised on its own as it would require high activity insertion which is ruled out by DEP[π] (the tableaux showing this evaluation is given in Appendix B to save space).

(43) Accented root + adsorbent suffix

$\overset{\pi_{0.5\mathrm{R}}}{\overset{\vert}{\mathrm{x}_{\mathrm{R}}}}$ $\overset{\pi_{0.5\mathrm{Ad}}}{\overset{\vert}{\mathrm{x}_{\mathrm{Ad}}}}$	**DEP [π]** **20**	**MAX [π]** **10**	**RM [π]** **2**	**UNI [π]** **1**	
☞ a. x_{R} $\overset{\pi_{1\mathrm{R+Ad}}}{\overset{\vert}{\mathrm{x}_{\mathrm{Ad}}}}$				1	1
b. $\overset{\pi_{1\mathrm{R+Ad}}}{\overset{\vert}{\mathrm{x}_{\mathrm{R}}}}$ x_{A}			1	1	3
c. $\overset{\pi_{1\mathrm{R}}}{\overset{\vert}{\mathrm{x}_{\mathrm{R}}}}$ x_{Ad}	0.5	0.5	1		17
d. x_{R} x_{Ad}		1			10

(44) Accented root + attractive suffix

$\pi_{0.5\text{R}}$ $\pi_{0.5\text{At}}$ | x_R x_R x_At	**Dep [π]** **20**	**Max [π]** **10**	**Rm [π]** **2**	**Uni [π]** **1**	
☞ a. $\pi_{1\text{R}+\text{At}}$ | x_R x_R x_At			1	1	3
b. $\pi_{1\text{R}+\text{At}}$ | x_R x_R x_At			2	1	5
c. $\pi_{1\text{R}}$ | x_R x_R x_At	0.5	0.5	2		19
d. x_R x_R x_At		1			10

The usurper suffix bears a very weak floating accent ($\pi_{0.1}$) whose deletion is preferred under the constraint weightings. As shown below, the optimal candidate is always accentless with this suffix, whether the root is accentless (45-a) or accented (46-a). This follows from the high weighting of Dep[π], which disfavors activity insertion (45-b,c). With accented roots, merging the suffix accent with the root's would require an activity insertion of 0.4, which is sufficient to rule out candidates (46-b,c).

(45) Accentless root + usurper suffix

$\pi_{0.1\text{Us}}$ x_R x_R x_Us	**Dep [π]** **20**	**Max [π]** **10**	**Rm [π]** **2**	
☞ a. x_R x_R x_Us		0.1		1
b. $\pi_{1\text{Us}}$ ⋮ x_R x_R x_Us	0.9			18
c. $\pi_{1\text{Us}}$ ⋮ x_R x_R x_Us	0.9		1	20

(46) Accented root + usurper suffix

$\overset{\overset{\pi_{0.5R}}{\vert}}{x_R}\ x_R\ \overset{\pi_{0.1Us}}{x_{At}}$	**Dep** [π] **20**	**Max** [π] **10**	**Rm** [π] **2**	**Uni** [π] **1**	
☞ a. $x_R\ x_R\ x_{Us}$		0.6			6
b. $\overset{\overset{\pi_{1R+Us}}{\vert}}{x_R}\ x_R\ x_{Us}$	0.4		2	1	9
c. $x_R\ \overset{\overset{\pi_{1R+Us}}{\vert}}{x_R}\ x_{Us}$	0.4		1	1	7

The dominant suffix bears an accent with full activity (1), which always surfaces faithfully on the suffix; the root accent which is weaker, is deleted, as shown in (47-a). However, this mechanism mispredicts the behaviour of recessive suffixes. For example, with a recessive suffix bearing slightly weaker activity (e.g. $\pi_{0.9}$), the optimal candidate would incorrectly show accent on the suffix, as in (48-b). Slightly reducing the suffix's activity still results in incorrect rightmost accentuation, while lowering it too much yields an accentless form, i.e. a usurpation effect, see (46). This shows a conflict in the system: the mechanisms underlying dominance and recession require opposite constraint weightings and therefore cannot be straightforwardly unified. The system also fails to capture the behaviour of accentless recessive suffixes (e.g. /-ga/ Nom): here, a root accent ($\pi_{0.5}$) remains unrealised in the absence of a coalescing accent, again resulting in a usurpation effect. Modelling the recessive suffix with a floating accent does not resolve the issue either, as it incorrectly yields preaccentuation, discussed below.

(47) Accented root + dominant suffix

$\overset{\overset{\pi_{0.5R}}{\vert}}{x_R}\ \overset{\overset{\pi_{1D}}{\vert}}{x_D}$	**Dep** [π] **20**	**Max** [π] **10**	**Uni** [π] **1**	**Rm** [π] **2**	
☞ a. $x_R\ \overset{\overset{\pi_{1D}}{\vert}}{x_D}$		0.5			5
b. $x_R\ \overset{\overset{\pi_{1R+D}}{\vert}}{x_A}$		0.5	1		6
c. $\overset{\overset{\pi_{1R+D}}{\vert}}{x_R}\ x_D$		0.5	1	1	8

(48) Accented root + recessive suffix

$\overset{\pi_{0.5R}}{x_R}\ \overset{\pi_{0.9Re}}{x_{Re}}$	**Dep** [π]	**Max** [π]	**Uni** [π]	**Rm** [π]	
	20	**10**	**1**	**2**	
☹ a. $\overset{\pi_{1R}}{x_R}\ x_{Re}$	0.5	0.9		1	21
☞ b. $x_R\ \overset{\pi_{1R+Re}}{x_{Re}}$		0.4	1		5
c. $\overset{\pi_{1R+Re}}{x_R}\ x_{Re}$		0.4	1	1	7

A floating accent ($\pi_{0.9}$) in the representation of the dominant preaccenting suffix captures the preaccentuation pattern observed with both accentless and accented roots. As shown in (49-a), the suffix accent surfaces on the root-final mora due to the interaction of Rm[π] and Alternation (the latter not shown in the tableaux). Its activity is high enough to block deletion, ruling out (49-b). When combined with an accented root, the suffix accent merges with the root's accent and surfaces on the root-final mora, as shown in (50).

(49) Accentless root + dominant preaccenting

$x_R\ x_R\ \overset{\pi_{0.9DP}}{}\ x_{DP}$	**Dep** [π]	**Max** [π]	**Rm** [π]	
	20	**10**	**2**	
☞ a. $x_R\ \overset{\pi_{1DP}}{\vdots \atop x_R}\ x_{DP}$	0.1		1	4
b. $\overset{\pi_{1DP}}{\vdots \atop x_R}\ x_R\ x_{DP}$	0.1		2	6
c. $x_R\ x_R\ x_{Dp}$		0.9		9

(50) Accented root + dominant preaccenting

$\pi_{0.5R}$ $\pi_{0.9DP}$ x_R x_R x_{DP}	MAX [π] **10**	RM [π] **2**	UNI [π] **1**	
☞ a. π_{1R+DP} x_R x_R x_{DP}	0.4	1	1	7
b. π_{1R+DP} x_R x_R x_{DP}		1	2	5
c. x_R x_R x_{Dp}	1.4			14

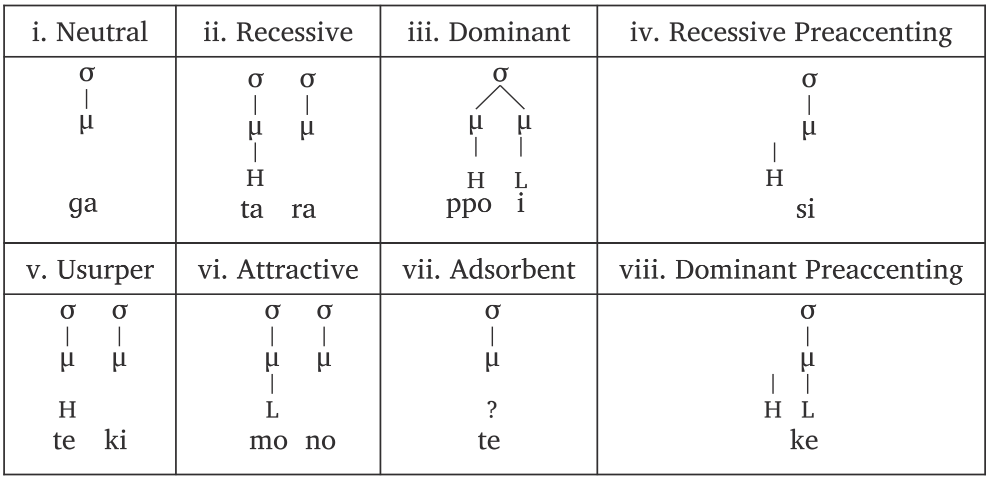
It remains unclear how the account could capture recessive preaccentuation. For example, a floating weak accent ($\pi_{0.6}$) yields either usurpation or attraction (see tableaux (45) and (44)), while a weak associated accent results in adsorption (see (43) and (66) in the Appendix). Adjusting activity levels does not resolve the issue. Although the activity scale is formally gradient, distinct accentual patterns do not emerge with each incremental change. Instead, different outcomes arise only at specific threshold values. When implemented in the grammar, the coalescence and deletion mechanisms can enforce only one of the conflicting patterns (e.g. dominance vs. recession, or dominant vs. recessive preaccentuation) at a time. This limitation suggests that the representational assumptions of Revithiadou's proposal, particularly the reliance on gradient input activity, are insufficient to capture the full range of attested suffix behaviours in Japanese. While the account offers an elegant treatment of codependency effects, it does not generalise to suffix types that do not involve morpheme codependency. A further issue concerns the treatment of root accent: roots must necessarily be weak in order to participate in coalescence-based realisation, on the assumption that weak accents surface only when merged to form a strong one (activity = 1). It remains unclear how roots with full activity would behave, as such cases fall outside the scope of the coalescence mechanism. Revithiadou (2023) addresses some of these issues by introducing constraint indexation. The alternative pursued here is to allow output gradience, while preserving a simple grammar built from independently motivated, general constraints.

5.3 Two-dimensional concatenation (Trommer 2019a)

This section discusses two alternative approaches to Japanese suffix accentuation: Kurisu (2001) and Trommer (2019a). Both expand the standard OT machinery and rely on comparatively complex representational or constraint-based mechanisms. I begin with Trommer's (2019a) representational model within Coloured Containment theory (Trommer 2011), which introduces the proposal of two-dimensional concatenation. Under this proposal, concatenation of floating affixes may apply not only horizontally but also vertically. Floating material may attach to a pivot on its own tier (Zimmermann 2014; Trommer & Zimmermann 2014), but it may also associate upward or downward to a pivot on an adjacent tier. Vertical association requires an additional complex autosegmental primitive: a floating element bearing a coloured association that enters the phonology as a pre-specified structural unit, represented here as H—.

Table (51) illustrates the underlying representations that Trommer (2019a) proposes for seven suffix classes in Japanese. Note that the suffix names are adapted for terminological consistency. The adsorbent suffix is neither included in the table nor analysed in detail. It therefore remains unclear how the account would derive its attraction effect. In the representations in (51), both H and L tones are lexically specified. An accented position is represented by a H-tone followed by a L-tone on the subsequent syllable. The analysis crucially relies on different association statuses of these tones to derive the various suffix effects. An underlyingly associated H not followed by L encodes recession (51-ii), whereas the presence of an underlyingly associated L in (51-iii, vi, viii) is intended to induce different dominance effects. A floating H in (51-v) is intended to derive subtraction, while the complex floating H— is required to derive preaccentuation.

(51) Underlying representation of Japanese tonal suffix classes (Trommer 2019b)



The constraints implementing these representations come in two versions: generalised and phonetic, the latter underlined in the tableaux.The general constraints refer to all output material, whereas the phonetic ones exclusively reference phonetically realised (visible) material. The crucial constraints include 1H (corresponding to Culm in my analysis), T→μ, Max T_1, which penalises phonetically invisible PW-initial tones, H⟺L, which requires a phonetic H to precede a phonetic L, and Fth L, which enforces faithful realisation of an underlying L. Fth L plays a central role in deriving the dominance effect of /-ppói/ '-ish' (52) and the strong preaccenting suffix /-ke/ ‘family of’ (53). As shown in the tableaux below, FTH L excludes candidates (52-b) and (53-b), which preserve the root tone at the expense of the suffix tone.

(52) Toned root + dominant suffix

Input = c	1H	H⇔L	FTH L	MAX T_1
☞ a. H H L ⋮ | | ki za ppo i				*
b. H L H L | ⋮ ⋮ ⋮ ki za ppo i			*!	
c. H H L | | | ki za ppo i	*!		*	

(53) Toned root + strong preaccenting suffix

Input = c	1H	H⇔L	FTH L	MAX T_1
☞ a. H H L ⋮ | | u ra ke				*
b. HLH L | ⋱⋮ ⋮ u ra ke			*!	
c. H H L | | | u ra ke	*!		*	

Trommer (2019a) further introduces a specific constraint, ⚓–F, which penalises a phonetic H–L sequence whose H bears a nonmorphological (i.e. epenthetic) association. It thus functions as a hybrid constraint: it simultaneously references phonetic tones and morphological association lines. This constraint is crucial for deriving the interaction of a recessive suffix with a toneless root. It ensures faithful realisation of the suffixal H-tone by excluding candidate (54-b). The formulation of ⚓–F must be sufficiently complex to avoid incorrectly excluding optimal candidates such as (55-a), where an attractive suffix shifts the root tone. This candidate satisfies ⚓–F only because the root H retains a morphologically invisible association line.

(54) Toneless root + recessive toned suffix

Input = yom-tara	⚓–F	H⇔L	FTH L	MAX T_1
☞ a. H L | ⋮ yon da ra				
b. H H L ⋮ ⋮⋰ yon da ra	*!			*
c. H | yon da ra		*!		

(55) Toned root + attractive suffix

Input = c	⚓–F	H⇔L	FTH L	MAX T_1
☞ a. H L ⋮⋱ | ka ki mo no				*
b. H L L | ⋮ ⋮ ka ki mo no			*!	
c. H L | | ka ki mo no		*!*		

While Trommer's account offers an elegant extension of Coloured Containment and provides a unified representational treatment of multiple suffix types, excluding the adsorbent class„ it does so at the cost of introducing (i) complex floating primitives, (ii) vertically specified concatenation, and (iii) hybrid constraints that reference both phonetic and morphological structures. These mechanisms considerably expand the theoretical apparatus of OT and raise questions about restrictiveness and learnability. In contrast, the present account derives the same effects using independently motivated constraints without recourse to unmotivated concatenation operations.

5.4 Realise Morpheme Theory (Kurisu 2001)

The other account of suffix accentuation in Japanese is Kurisu's (2001) Realise Morpheme Theory (RMT), which is based on the assumption that the presence of a morpheme in the underlying representation must be expressed through some phonological change in the output. A central constraint in this model is REALISE MORPHEME (RM), defined below.

(56) Realise Morpheme (RM) (Kurisu 2001: 39)
Let α be a morphological form, β be a morphosyntactic category, and $F(\alpha)$ be the phonological form from which $F(\alpha+\beta)$ is derived to express a morphosyntactic category β. Then RM is satisfied with respect to β iff $F(\alpha+\beta) \neq F(\alpha)$ phonologically.

To capture dominance effects in Japanese, the RM account is supplemented with Sympathy Theory (McCarthy 1999), an extension of OT that evaluates inter-candidate correspondence. For example, the usurpation effect of /kko/ 'native of' is by designating a sympathy candidate via a selector constraint (marked ❀), rendering the suffix opaque. An accentless root, e.g. *koobe* 'Kobe' is selected as a sympathy candidate. The optimal candidate *koobe-kko* 'native of Kobe' must imitate the absence of accent in the sympathy candidate due to the selector constraint Dep-❀O-Accent. Accent deletion thus emerges as the strategy for satisfying RM. Although this mechanism captures the usurpation effect, it does not derive the adsorption effect (as also noted for Trommer 2019a). Moreover, non-local affix-induced accentuation is in principle excluded under the architecture of the theory. Kurisu (2001) further proposes the Morpheme-Contiguity assumption, according to which all segmental and suprasegmental elements expressing a given morpheme must be realised contiguously. This assumption is captured by the constraint Morph-Contiguity, which is crucially undominated. As a result, preaccentuation must be strictly local, which poses a challenge for suffixes such as root-initial-accenting /-zu/ in Japanese. To capture the remaining suffix accentuation patterns, Kurisu (2001) resorts to constraint indexation, further increasing the complexity of the analysis. As Kurisu (2001: 213) explicitly states, "each faithfulness constraint must inherently bear the type marking of the relevant affix," since the ranking of constraints such as Max-IO-Accent varies across affixes.

The brief review of alternative accounts shows that each relies on substantial extensions of OT, raising concerns about theoretical economy and restrictiveness, while also exhibiting more limited empirical coverage than the present analysis. The TAF account (Alderete 1999) introduces a new family of antifaithfulness constraints which require direct reference to morphological information through indexation. Moreover, the system encounters a ranking paradox when attempting to derive multiple accentual suffix types within a single grammar. Trommer (2019a) expands the representational apparatus of autosegmental OT by introducing complex floating primitives (e.g. H—) and vertical concatenation. Tt remains unclear how this machinery generalises to suffixes such as the adsorbent, which combine subtractive and attractive properties. Realise Morpheme Theory (Kurisu 2001) shares similar empirical limitations and relies on Sympathy Theory and constraint indexation. Its Morpheme-Contiguity assumption further restricts accentual effects to strictly local domains, making non-local accentuation difficult to accommodate. In contrast, the GSR account developed here captures a broader range of Japanese while maintaining the

Indirect Reference Hypothesis and employing only independently motivated constraints within Harmonic Grammar.

6 Conclusion and outlook

This paper has shown that a wide range of suffix-induced accentual effects in Japanese can be derived from differences in suffixes' gradient tonal and moraic representations. More specifically, tones and TBUs with gradient activity compete for association: the most active element wins, and when activity levels are equal, the rightmost element wins. These patterns follow from two core principles: (A) competition among gradiently active H-tones and moras, and (B) a rightmost preference for tone realisation. Standard markedness constraints sensitive to gradient output activity, such as H ⊳ μ and μ ⊳ H, implement (A), while ALIGN-R H ensures right-edge alignment when activity levels are equal. Crucially, these are independently motivated constraints from the literature on tone. The analysis therefore requires neither constraint indexation, Transderivational Antifaithfulness, nor representational innovations such as 'vertical concatenation'. In this respect, it differs from alternative accounts such as Kurisu (2001), Alderete (1999), and Trommer (2019a).

The proposed account also opens the possibility of unifying suffix accentuation with other aspects of Japanese tonal phonology, particularly compound accentuation. These domains have been analysed separately and within distinct theoretical frameworks: suffix accentuation is typically treated in non-metrical terms (Alderete 1999; Kurisu 2001; Trommer 2019a), whereas compound accentuation has been approached using metrical frameworks (e.g. Kubozono 1995; Kubozono & Mester 1995; Ito & Mester 2016). This divide reflects the apparent incompatibility of the mechanisms assumed for each domain. For instance, compound accentuation is analysed as depending on the prosodic size of the second member (N2). A simplified generalisation from McCawley (1968) states that compound tone surfaces (i) at the juncture of the two members, prejuncturally when N2 is short and postjuncturally when N2 is long, or (ii) near the right edge of the compound when N2 is superlong. A fully integrated analysis of compound accentuation lies beyond the scope of the present paper but see (Shojaei 2023b). The crucial point here is that both suffix and compound accentuation can be derived from the same rightmost preference for tone realisation. Different compound patterns arise from threshold effects that vary with the size and accentual specification of the compound members. Such cumulative and threshold interactions are naturally captured within HG through weighted constraints.

Finally, the analysis developed here may extend beyond Japanese. Because it is fully representational, it predicts locality effects: a floating tone may dock only onto an adjacent mora, and a floating mora may usurp only an adjacent tone. The two core principles, (A) competition between gradiently active morphemes and (B) preference for edge-most tone realisation, are not language-specific. Independent case studies of Choguita Rarámuri stress-accent (Shojaei

2023a) and A’ingae stress (Shojaei 2025) show that gradient HG captures complex patterns of accent attraction and subtraction in those systems using the same mechanisms developed here. The broader typological and theoretical implications of the gradient representational approach developed here remain to be fully explored.

Appendix A

This appendix repeats all of the constraints used in this paper and their definitions in (57). The constraints are included in the tableaux below to show their interactions deriving the various suffix-induced patterns. Also, the tableaux add different suboptimal candidates that were excluded for space reasons.

(57) Constraints used in this paper

a. CULM(INATIVITY) H: Assign violation 1 for every word with more than one properly integrated H-tone.

b. H ▷ μ: Assign violation X for every H-tone with activity X that is not associated to a μ.

c. μ ▷ H: Assign violation X for every μ with activity X that is not associated to a H-tone.

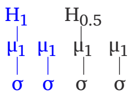
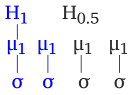
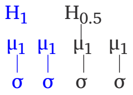
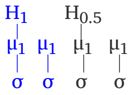
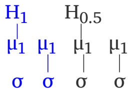
d. V ▷ μ: Assign violation 1 for every V-node that is not associated to a μ through an uninterrupted path of association lines.

e. ALIGNR H: Assign violation 1 for every properly integrated μ that intervenes between the prosodic word's right edge and the rightmost properly integrated μ that bears a H-tone.

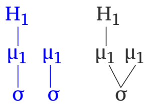
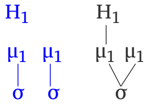
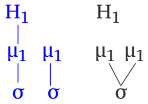
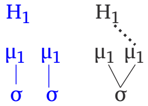
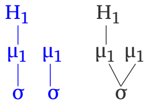
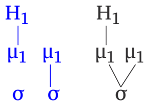
f. ALT(ERNATION): Assign violation 1 for every epenthetic association line between tautomorphemic elements.

g. DEP |: Assign violation 1 for every output association line without a correspondent input association line.

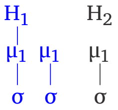
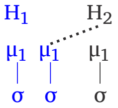
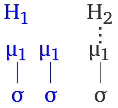
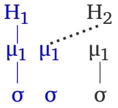
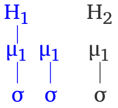
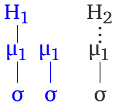
(58) Recessive suffix effect: tábe-tára → tábetara 'if eat'

Input:		CULM H 200	V ▷ μ 95	μ ▷ H 30	H ▷ μ 30	DEP | 7	ALT 4	ALIGNR H 0.5	
☞ a.				3	0.5			3	106.5
b.				3	1			1	120.5
c.		1		2				3	261.5
d.			1	2				1	155.5

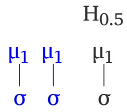
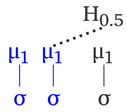
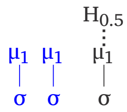
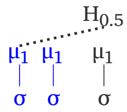
(59) Pure dominance effect: kíza-ppói → kizappói ‘snobbish’

Input: 	CULM H	V ▷ μ	μ ▷ H	H ▷ μ	DEP |	ALT	ALIGNR H	
	200	95	30	30	7	4	0.5	
☞ a. 			3	1			1	120.5
b. 			3	1			3	121.5
c. 			3	1	1	1		131
d. 	1		2					230
e. 		1	2				1	155.5

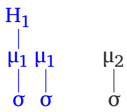
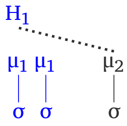
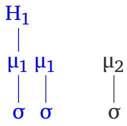
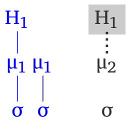
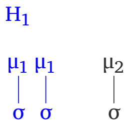
(60) Dominant preaccentuation: úra-ke → uráke ‘family of Ura’

Input: 	CULM H	V ▷ μ	μ ▷ H	H ▷ μ	DEP |	ALT	ALIGNR H	
	200	95	30	30	7	4	0.5	
☞ a. 			2	1	1		1	97.5
b. 			2	1	1	1		101
c. 		1	1		1		1	102.5
d. 			2	2			2	121
e. 	1		1		1	1	2	242

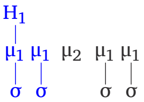
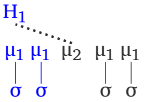
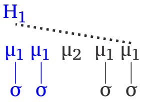
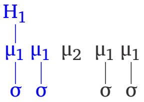
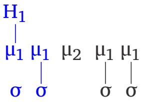
(61) Recessive preaccentuation: ono-si → onósi ‘Mr. Ono’ (cf. tableau 27)

Input: 	CULM H 200	V ⊳ μ 95	μ ⊳ H 30	H ⊳ μ 30	DEP | 7	ALT 4	ALIGNR H 0.5	
☞ a. 			2		1		1	37.5
b. 			2		1	1		41.5
c. 			2		1		2	38

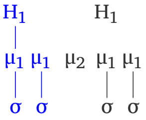
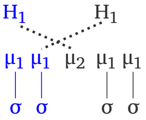
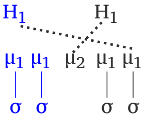
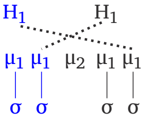
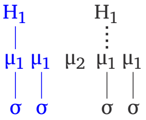
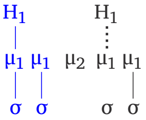
(62) Tone adsorption: káki-te → kakité ‘narrator’

Input: 	CULM H 200	V ⊳ μ 95	μ ⊳ H 30	H ⊳ μ 30	DEP | 7	ALT 4	ALIGNR H 0.5	
☞ a. 			2		1			67
b. 			3				2	91
c. 		1	1		1	1	1	136.5
d. 			4	1				150

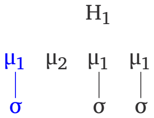
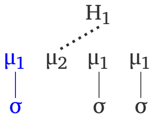
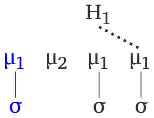
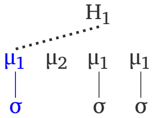
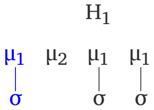
(63) Tone usurpation: rónri-teki → ronriteki ‘logical’

Input: 	Culm H	V ⊳ μ	μ ⊳ H	H ⊳ μ	Dep |	Alt	AlignR H	
	200	95	30	30	7	4	0.5	
☞ a. 			4		1			127
b. 			5		1			157
c. 			5				3	151.5
d. 		1	5				3	246.5

(64) Tone attraction: káki-mono → kakímono ‘thing to write’

Input: 	Culm H	V ⊳ μ	μ ⊳ H	H ⊳ μ	Dep |	Alt	AlignR H	
	200	95	30	30	7	4	0.5	
☞ a. 			3		2		2	105
b. 			3		2	1	2	109
c. 			4		2		2	135
d. 	1		4		1	1	4	333
e. 		1	4		1	1	2	227

(65) No attraction with a toneless root: ni-mono → nimono ‘cooked food’

Input: 	CULM H	V ⊳ μ	μ ⊳ H	H ⊳ μ	DEP |	ALT	ALIGNR H	
	200	95	30	30	7	4	0.5	
☞ a. 			3		1	1		101
b. 			4		1	1		131
c. 			4		1		2	128
d. 			5	1				180

Appendix B

This appendix provides part of the constructed analysis of the adsorbent and attractive suffixes based on Revithiadou (2023), which was not included in Section 5.2 to save space of the paper. When the adsorbent or attractive suffix combines with an accentless root, the optimal output is an unaccented form, as shown in candidates (66-a) and and (67-a). The suffix’s weak accent is not realised on its own as shown in (66-b,c) and (67-b,c) which are ruled out by DEP[π], that penalises activity insertion.

(66) Accentless root + adsorbent suffix

$x_R\ \overset{\pi_{0.5Ad}}{\overset{\vert}{x_{Ad}}}$	DEP [π]	MAX [π]	UNI [π]	RM [π]	
	20	**10**	**1**	**2**	
☞ a. $x_R\ x_{Ad}$		0.5			5
b. $x_R\ \overset{\pi_{1Ad}}{\overset{\vert}{x_{Ad}}}$	0.5				10
c. $\overset{\pi_{1Ad}}{\overset{\vert}{x_R}}\ x_{Ad}$	0.5			1	12

(67) Accentless root + attractive suffix

$\pi_{0.5At}$ x_R x_{At}	**Dep** [π] **20**	**Max** [π] **10**	**Uni** [π] **1**	**Rm** [π] **2**	
☞ a. x_R x_A		0.5			5
b. π_{1At} ⋮ x_R x_{At}	0.5				10
c. π_{1At} ⋮ x_R x_{At}	0.5			1	12

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Competing interests

The author has no competing interests to declare.

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