The Emergence of the Unmarked in Early Prosodic Structure

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1. Introduction

In Optimality Theory (Prince and Smolensky 1993), structural markedness derives from many dimensions of harmonic evaluation within the grammar. Even when a constraint which militates against certain markedness is rendered inactive due to a dominating faithfulness constraint, its effects can still be visible where the faithfulness constraint is irrelevant to the evaluation, giving rise to a state known as *the emergence of the unmarked* (McCarthy and Prince 1994). Thus, in Optimality Theory (OT) markedness is not categorically surface-true (or untrue) throughout a grammar, but shows effects that differ with respect to domains within the grammatical system.

In this paper, I present evidence that this fundamental property of Optimality Theoretic grammar is evident in child language. The empirical case I examine is word truncation in early Japanese. The regularity seen in the size and shape of the truncated words cannot be explained in terms of prosodic regulations that dictate the child's phonological system as a whole.[1] Instead, the data show that truncated words in child Japanese conform to their own set of well-formedness requirements. I therefore argue that child phonology exhibits the essential properties of constraint ranking underlying the emergence of the unmarked, and that the basic mechanism of a constraint-based grammar is present and operative in the non-steady state.

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[1] In this respect, the type of truncation under discussion qualitatively differs from the previously reported cases of word truncation in other well-studied child languages such as child English. See Section 3.

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The paper is organized as follows. Section 2 outlines a formulation of the emergence of the unmarked within the framework of Correspondence Theory. A model of morphological truncation proposed by Benua (1995) will be introduced as a background of the analysis. Section 3 provides an overview of the truncation data in child Japanese. Section 4, the main body of the paper, presents the truncation phenomenon as a case of emergent unmarkedness. Section 5 discusses the implications of the findings and concludes the paper.

2. The emergence of the unmarked in Correspondence Theory

The emergence of the unmarked has received a formal characterization in Correspondence Theory (McCarthy and Prince 1994, 1995). Correspondence Theory abstracts the original conception of faithfulness in Prince and Smolensky (1993) into one that applies to any formal relation between representations. Correspondence is defined as follows:

(1) *Correspondence* (McCarthy and Prince 1995):
Given two strings S_1 and S_2, correspondence is a relation $\Re$ from the elements of S_1 to those of S_2. Elements $\alpha \in S_1$ and $\beta \in S_2$ are referred to as correspondents of one another when $\alpha \Re \beta$.

Under this formalization, the emergence of the unmarked arises when some markedness constraint $\mathbb{M}$ is ranked below constraints on lexical-surface correspondence (IO-Faith), but above constraints on a different correspondence relation (represented as $\mathbb{F}$ below).

(2) Skeletal ranking for the emergence of the unmarked

IO-Faith >> $\mathbb{M}$ (Markedness) >> $\mathbb{F}$

In this ranking, the effects of IO-Faith will override those of $\mathbb{M}$ when the two are in conflict. But the correspondence regulated by $\mathbb{F}$ must yield to the requirements of $\mathbb{M}$. Thus, structures unmarked with respect to $\mathbb{M}$ 'emerge' in the domain relevant to $\mathbb{F}$.

Originally proposed by McCarthy and Prince (1993a) in their analysis of reduplicative copying, correspondence has been extended to other representational relations, including prosodic circumscription (McCarthy 1995), intra-paradigmatic relation (Kenstowicz 1996), and argot word formation (Itô, Kitagawa and Mester 1996). In the Correspondence model of truncation (Benua 1995), the truncated form is in correspondence with its base, which in turn is in correspondence with the lexical input. The example below illustrates the case of Japanese hypocoristics formation in which a name, such as /midori/, is truncated to the bimoraic forms [mido] and [mii].

(3) A Correspondence model of morphological truncation (Benua 1995)

BT-Identity

Base [(mi.do)ri] ↔ Truncated Form [mido][mii]
IO-Faith ↕
Input /midori/ 'midori'

In this model, morphological truncation involves two sets of correspondence constraints: one that governs the correspondence between the input and the base (IO-Faith), and another that governs the correspondence between the base and the truncated form (BT-Identity). The ranking shown in (4), characteristic of the emergence of the unmarked, gives rise to templatic effects in the truncated output forms.

(4) The emergence of the unmarked in 'templatic' truncation

IO-Faith >> Prosodic markedness >> BT-Identity

In (4), BT-Identity, but not IO-Faith, is subordinate to the markedness constraints. As a result, the output forms which are in correspondence with the base must conform to the demands of the prosodic markedness, hence producing the templatic effects.

In the remainder of this paper, I propose that this scenario also applies to the truncation phenomenon in child Japanese. The pattern of early word truncation receives a natural account within the Correspondence Theoretic model of truncation just outlined (Benua 1995). For this reason, I argue that truncation in early Japanese instantiates the interaction of basic prosodic constraints ranked in the schematic order in (4).

3. Word truncation in child Japanese

The data used in this study come from Noji's (1974-77) diary of his son Sumihare's acquisition of Japanese and Miyata's (1995) tape-recorded longitudinal study of her subject Aki.[2] The current analysis focuses on a stage at which the mean length of utterance was approximately between 1.0 and 1.5 (age 1;9.0-2;1.30 for Sumihare and 2;0.5-2;4.29 for Aki). I restrict my attention to the most robust patterns of word truncation common to both children during this period.[3] These are sampled in (5).[4]

[2] Transcriptions of Miyata (1995) were taken from the CHILDES database (MacWhinney & Snow 1985).

[3] I used 75% predictability as a cut-off point. That is, for example, when an LHL target is truncated, the output is HL over 75% of the total cases. There are other attested output forms (e.g. LL) which are less productive and do not participate in such a predictable mapping relation. Although I have proposed an analysis which attempts to account for these less systematic cases (see Ota, to appear), further probings into this issue require a larger corpus of child Japanese data, and must be left as a task for future research.

[4] Notation: H = heavy syllable; L = light syllable

(5)

	Target form	Truncated production	Meaning	Child
a.	LHL	HL		
	poketto	pekko[5]	pocket	S
	dʒido:ʃa	do:ʃa	car; automobile	A
	toɾakku	takku	truck	A
	kaɾappo	tappo	empty	S
b.	H...L...	HL		
	empit^{s}ɯ	empi	pencil	S
	mensoɾe:tamɯ	mentʃo / bentʃo	Mentholatum™	S
	ʃo:bo:ʃa	ʃo:ʃa	fire engine	A
	o:tobai	o:to	motorbike	A
c.	LLL	HL		
	tamago	ta:ma	egg	S
	radʒio	ra:dʒi	radio	S
	kɯdʒiɾa	kɯddʒa / ko:dʒa	whale	A
	omeme	o:me	eye	A
d.	(L)LH	H		
	takai	tai	high	S
	akai	kai	red	S
	bɯdo:	bo:	grape	A
	oʃimai	mai	all-done	A
e.	HH	H		
	ippai	pai	a lot	A
	oppai	pai	breast	S
	tʃo:dai	tʃo:	gimme	S
	kjande:	kjan	candy	S

The data in (5) reveal a fairly rigid restriction on the prosodic shape and size of truncated words. The only productive truncated forms are H (a heavy syllable) and HL (a sequence of heavy and light syllables). Templatic effects on early word production have been reported in a number of child languages, including English (Echols and Newport 1992, Gerken 1994), Dutch (Fikkert 1994), Hungarian (Fee 1995), and Sesotho (Demuth 1996). A well-known case is the truncation phenomenon observed in a stage of development in English acquisition during which disyllabic and heavy monosyllabic structures prevail in the production. Longer target words are truncated down to these forms. However, most of the reported truncation data in child languages do not motivate

[5] This and many other examples in (5) present an interesting pattern of onset preservation which appears to depend largely on the featural characteristics of the consonants. Since our main concern here is prosody, I will not pursue this issue further, but see Gnanadesikan (1995) and Pater (1996) for extensive OT analyses of onset preservation in early word production.

postulation of multi-dimensional markedness, as the truncation process tends to apply categorically to the overall word production. Since the unmarked structure is the only permissible output form in the entire phonological system, the phenomena can be accounted for by simply ranking IO-Faith below markedness constraints that limit the prosodic word, for example, to a single binary foot, as in Demuth (1995) and Pater (1996).

In contrast, the truncation observed in Sumihare's and Aki's 'ord production is not an always-or-never affair. The data in (5) exemplify the shape of possible truncated words but not that of all productions. Although the truncated words are shown to have no more than two syllables, most productions of targets with three or more syllables are exempt from such a restriction. In Sumihare's production, for example, 82.5% of the target words with three or more syllables are not truncated. For Aki, the percentage is 79.3%. Furthermore, many targets are found both in truncated and non-truncated forms. For instance, of the lexical items Aki used three or more times in any recorded session, 78% of the truncated forms appear in the same session with their non-truncated counterparts. Some examples are given in (6):[6]

(6)

Adult form	Truncated	Non-truncated	Meaning	Child (Age)
ippai	pai	ippai	'lots'	A (2;1.24)
toɾakkɯ	takkɯ	towakkɯ	'truck'	A (2;1.24)
ʃɯppatˢɯ	ʃɯppa	ʃɯppatˢɯ	'all aboard'	A (2;3.18)
dʒido:ʃa	do:ʃa	ʒədo:ʃa / ʃido:ʃa	'car'	A (2;4.4)
katai	tai	katai	'hard'	S (1;9)
kompe:to:	petto	tampetto:	'confetti'	S (1;10)
hajai	jai	hajai	'fast'	S (2;0)

I argue therefore, that truncated words in the child Japanese data are subject to a specific set of prosodic restrictions which do not affect the rest of the phonological system of the child. In other words, the process of truncation constitutes a domain in the phonological system with its own set of well-formedness requirements. In the next section, I present arguments in support for this hypothesis. Specifically, using the framework of Correspondence Theory, I show that the phenomenon can be best understood in terms of the interaction of prosodic markedness constraints with two separate sets of constraints on correspondence.

4. Emergent unmarkedness in child Japanese truncation

4.1 Templatic effects

As mentioned above, the pattern of truncation in child Japanese words exhibits templatic effects in the sense that the resulting outputs must take either the shape of H or HL. Generally, when the target word contains a heavy syllable but no light syllables to its right, the truncated form is H. Otherwise, the truncated form is HL. The pattern of truncation can thus be schematized as below:

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[6] The examples for Aki (A) are compiled from his weekly recordings. Each pair occurred on the same day. For Sumihare (S), the truncated and non-truncated forms are matched within the same month, since the amount of data collected on a single day was not large enough to include repeated production of the same target word.

(7) The shape of truncated forms (descriptively)[7]

a. **...H...L...**	-> **HL**	ex. ʃoo.boo.ʃa (HHL) -> ʃoo.ʃa 'fire engine'
b. **...H...(no L)**	-> **H**	ex. ip.pai (HH) -> pai 'a lot'
c. **...(no H)...**	-> **HL**	ex. ta.ma.go (LLL) -> ta:ma 'egg'

This inventory of output forms (i.e., H and HL) does not match any of the set of licit output forms in various types of prosodic morphological operations in adult Japanese.

(8) Possible output forms in adult Japanese prosodic morphology

a. {LL, H}	Hypocoristics, rustic girls' names (Poser 1990, Mester 1990)
b. {H}	Geisha client names (Poser 1990, Mester 1990)
c. {LL, HL, LLL, LLLL, LLH, HLL, HH}	Loanword clipping (Itô 1990, Itô and Mester 1992)
d. {HL, LLL, LLLL, LLH, HLL, HH}	Zuuja-go argot (Itô, Kitagawa and Mester 1996)

This shows that the truncation pattern attested in child Japanese is not a direct import of these morphological operations in the target language. In other words, the phenomenon is unique to the developing phonological system. However, I argue that this uniqueness is simply a reflection of the constraint ranking particular at this stage of development, and that the underlying mechanisms of the grammar and the constraints involved are the same as those in the prosodic morphology of the target language.

The markedness constraints which account for the pattern of truncation in (7) are the following:

(9) FTBIN (Prince 1980)
Feet are binary on syllables or moras.

ALIGN-FT-L (McCarthy and Prince 1993b)
= Align (Ft, L, PrWd, L); Every foot is left aligned with a prosodic word.

UNARITY (Green 1996)
A prosodic category Π contains no more than one of the next lower prosodic category Π – 1.

As feet are bimoraic in Japanese (Poser 1990, Mester 1990, Itô 1990), FTBIN is set to operate on moras. The specific instantiation of UNARITY which is relevant here is UNARITY(FT), where the category Π is the foot. In this formation, UNARITY restricts feet to one syllable. The effects of these constraints are visible in the prosodic morphology of

[7] For the sake of brevity, phonemic transcriptions are used in these and other non-transcriptional presentations including the tableaux. Note: /j/ = [dʒ], /y/ = [j], /u/ = [ɯ], /tu/ = [tsɯ], /ču/ = [tʃɯ], /N/ = moraic nasal. Long vowels are indicated by doubles, e.g. /oo/ = [o:].

adult Japanese. For instance, consider the following name truncation discussed by Poser (1990) and Mester (1990).

(10) Geisha client names

Tanaka	o-Taa-san, *o-Tana-san
Fukuda	o-Fuu-san, *o-Fuku-san
Honda	o-Hoo-san, o-Hon-san
Saiki	o-Saa-san, o-Sai-san

In this pattern of morphological truncation, the stem (which takes the honorific affixes *o-* and *-san*) consists of a single bimoraic foot in compliance with FTBIN and ALIGN-FT-L[8]. Furthermore the foot must be monosyllabic due to UNARITY(FT). Thus *o-Taa-san* is a licit client name for *Tanaka*, but *o-Tana-san* is not.

The constraint on correspondence relevant to child Japanese truncation is seen to be one that maximizes string-wise correspondence from the base word to its truncated form:

(11) MAX-BT
Every element in the Base has a correspondent in the Truncated form

Ranking FTBIN, ALIGN-FT-L and UNARITY(FT) above MAX-BT produces the templatic deletion effects seen in child Japanese, as shown in (12).

(12) FTBIN, ALIGN-FT-L, UNARITY (FT) >> MAX-BT

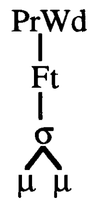
Base		FTBIN	ALIGN-FT-L	UNARITY(FT)	MAX-BT
jidooʃa 'car'	a. (jidooʃa)	*!			
	b. ji(doo)ʃa		*!		
	c. (doo)				**!**
	d. ☞ (doo)ʃa				**
takai 'high'	e. (takai)	*!			
	f. ta(kai)		*!		
	g. (taka)			*!	*
	h. ☞ (kai)				**

In (12a-d), the optimal candidate (d) violates MAX-BT. However, it fully conforms to the restrictions of FTBIN, ALIGN-FT-L and UNARITY (FT), and incurs fewer violations of MAX-BT than candidate (c). In (12e-h), the optimal candidate (h) fares worse than the other candidates in terms of MAX-BT, but still best satisfies the higher-ranked markedness constraints. The demands of the markedness constraints must be met even at the expense of segment preservation. As a result, the only permissible outputs are those with one

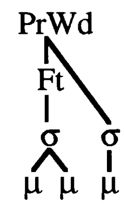
[8] It must also satisfy PARSE-σ (syllables must be parsed into feet), since unfooted syllables are disallowed (Benua 1995). The truncation phenomenon in child Japanese is different in this respect (see below).

bimoraic, monosyllabic foot left-aligned with the prosodic word. Only two prosodic structures conform to these restrictions.

(13) Prosodic structure of truncated words

a. 

ex. <a>ka i 'red'
kya n <dee> 'all-done'

b. 

<ji> do o ʃa 'car'
e N pi <tu> 'pencil'

The structure in (13a) consists only of a bimoraic monosyllabic foot. The structure in (13b) contains an unfooted light syllable, adjoined to the prosodic word in a 'weak layering' configuration in the sense of Itô and Mester (1992). I assume that a higher-ranked constraint that militates against two successive unparsed moras or syllables (LAPSE as defined in Green and Kenstowicz 1995. Cf. PARSE-2 in Kager 1994) rules out any structure with adjacent unfooted moras, e.g., $*_{PrWd}[_{Ft}(\sigma_{\mu\mu})\sigma_{\mu\mu}]$, $*_{PrWd}[_{Ft}(\sigma_{\mu\mu})\sigma\sigma]$.

The number of segments is not the only aspect of correspondence that is sacrificed to the prosodic requirements in child Japanese truncation. Since FTBIN and UNARITY(FT) assert that all feet must consist of only a heavy syllable, they force prosodic adjustments in the output when this demand cannot be satisfied by a heavy syllable in the target word. This effect can be seen in the mapping pattern in (7c). When the target word contains no heavy syllables, the initial light syllable of the target becomes heavy, e.g. /tamago/ -> [ta:ma], /makura/ -> [makka].[9] Effects of the constraint ensuring weight identity of the segments is overridden in these cases. This constraint can be defined as follows:

(14) IDENT-BT[weight]
Every element in the base has identical weight with its correspondent in the truncated form.

Since monosyllabicity of feet is guaranteed at the expense of weight identity, UNARITY(Ft) must dominate IDENT-BT[weight]. The interaction of these constraints is shown in (15).

(15) UNARITY(FT) >> IDENT-BT[weight]

Base: /ta$_\mu$ma$_\mu$go$_\mu$/ 'egg'	UNARITY(FT)	IDENT-BT[weight]
a. (ta$_\mu$ma$_\mu$)go$_\mu$	*!	
b. (ta$_\mu$ma$_\mu$)	*!	
c. ☞ (ta$_{\mu\mu}$)ma$_\mu$		*

[9] This can be realized by either vowel lengthening or gemination. A detailed analysis of this alternation lies outside the scope of this paper, although there is noticeable variation even on the same target word, as seen in the example: /kujira/ 'whale' -> [ko:dʒa] / [kɯddʒa].

The failed candidates (15a) and (15b) violate UNARITY(FT) but not IDENT-BT[weight]. On the other hand, the optimal candidate (c) satisfies UNARITY(FT), but violates IDENT-BT[weight] since it has mismatched weight in the first moraic segment.

To summarize the constraint ranking in child Japanese examined up to this point, we have seen that FTBIN, ALIGN-FT-L and UNARITY(FT) dominate MAX-BT, and that UNARITY(FT) outranks IDENT-BT[weight]. Putting these two rankings together, we obtain the following hierarchy of constraints.

(16) FTBIN ALIGN-FT-L UNARITY(FT)

MAX-BT IDENT-BT[weight]

The constraint ranking in (16) however does not completely account for the templatic effects generalized in (7). Specifically, it does not explain why HH targets are truncated to H instead of HL or why LH does not surface as HL. It also fails to offer an account for the preservation of initial syllable in the truncation of LLL targets. I will return to these issues in Section 4.3. The following section turns to the issue of input-output correspondence with respect to the three markedness constraints discussed above.

4.2 Multi-level faithfulness

The analysis thus far has established the ranking of three prosodic markedness constraints above BT-Identity constraints. In what follows, we will see evidence that these markedness constraints are ranked below constraints regulating IO-Faith. The relevant IO-Faith constraints are the following:

(17) MAX-IO
Every element in the input has a correspondent in the output.

DEP-IO
Every element in the output has a correspondent in the input.

IDENT-IO[weight]
Every element in the input has identical weight with its correspondent in the output.

First, productions of monomoraic target words show that FTBIN is dominated by DEP-IO and IDENT-IO[weight]. The vocabulary of standard Japanese contains a number of monomoraic lexical words, some of which are found in the child data:

(18)

Word	Meaning	First production	Word	Meaning	First production
me	'eye'	2;1 (A), 1;9 (S)	e	'picture'	2;1 (A)
te	'hand'	1;10 (A), 2;1 (S)	ki	'tree'	2;2 (A)
ni	'two'	1;11 (A)	çi	'sun'	2;2 (A)
ʃi	'four'	1;11 (A)	to	'door'	2;0 (S)
go	'five'	1;11 (A)	tʃi	'blood'	2;1 (S)

Without exceptions, these words are produced with the target's monomoraic prosodic structure. Assuming the undominated ranking of Lex ≈ PrWd (Prince and Smolensky 1993), every lexical word must have at least one foot. Thus FTBIN is violated in these cases, since the requirement that a foot be bimoraic cannot be met. Following Benua's (1995) analysis of Japanese prosody, I ascribe the force of this FTBIN violation to DEP-IO and IDENT-IO[weight], both of which must dominate FTBIN to prevent augmentation.

(19) DEP-IO, IDENT-IO [weight] >> FTBIN

Input: /me$_\mu$/ 'eye'	DEP-IO	IDENT-IO[weight]	FTBIN
a. (me$_\mu$N$_\mu$)	*!		
b. (me$_{\mu\mu}$)		!*	
c. ☞ (me$_\mu$)			*

Despite its violation of FTBIN, the optimal candidate (19c) is faithful to the weight of, and number of, segments. On the other hand, adding a segment (a) or lengthening the vowel (b) in order to satisfy FTBIN is not a possible option.

Next, ALIGN-FT-L can be shown to be dominated by MAX-IO. The relevant data are the following LH input-output pairs.

(20)

Adult form	Child production	Meaning	Age (child)
mikan	mitan	tangerine orange	S (1;9)
gobo:	gobo:	burdock	S (1;10)
miʃin	miʃin	sewing machine	S (2;0)
kiɾin	kijin	giraffe	A (2;0)
bɯdo:	mɯdo:	grape	A (2;2)
kikai	kikai	machine	A (2;4)

The outputs in (20) are prosodically organized such that a foot is aligned to the right, as illustrated by candidate (b) in (21). This optimal candidate therefore fails to satisfy ALIGN-FT-L. In comparison, the failed candidate (a) satisfies ALIGN-FT-L, but violates MAX-IO. Thus, MAX-IO must dominate ALIGN-FT-L.

(21) MAX-IO >> ALIGN-FT-L

Input: /gobo$_{\mu\mu}$/ 'burdock'	MAX-IO	ALIGN-FT-L
a. (boo)	*!*	
b. ☞ go(boo)		*

Finally, the data in (22) provide evidence that DEP-IO[weight] and IDENT-IO[weight], which have been shown to rank above FTBIN, also dominate UNARITY(FT).

(22)

Adult target	Child Production	Meaning	Child (Age)
mado	bado	window	S (1;9)
ame	ame	candy	S (1;10-1;11)
jɯki	jɯki	snow	S (1;9)
hato	hato	pigeon	A (2;1-2;3)
kami	kami	paper	A (2;1-2;4)
baʃɯ	baʃɯ	bus	A (2;0-2;4)

I will assume, with Itô 1990 and Benua 1995, that FTBIN is only violated by monomoraic words in Japanese, but not violable otherwise. The outputs in (22) must then have a disyllabic foot as shown in candidate (c) in (23).

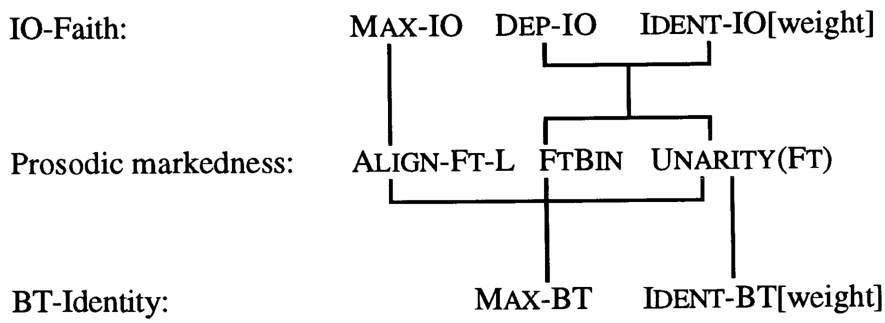
(23) DEP-IO, IDENT-IO[weight] >> UNARITY(FT)

Input: /ka$_\mu$mi$_\mu$/ 'paper'	DEP-IO	IDENT-IO[weight]	UNARITY(FT)
a. (ka$_\mu$i$_\mu$)mi$_\mu$	*!		
b. (ka$_{\mu\mu}$)mi$_\mu$		*!	
c. ☞ (ka$_\mu$mi$_\mu$)			*

The optimal candidate (c) violates UNARITY(FT) though not DEP-IO or IDENT-IO[weight]. Candidates (a) and (b), while committing no violations of UNARITY(FT), fail to satisfy either DEP-IO or IDENT-IO[weight]. Since it is better to make give up foot monosyllabicity than to sacrifice weight identity or to add new segments, DEP-IO[weight] and IDENT-IO[weight] must be ranked above UNARITY(FT).

I have demonstrated in (19) through (23) that the three markedness constraints FTBIN, ALIGN-FT-L and UNARITY(FT) are dominated by IO-Faith constraints: both FTBIN and UNARITY(FT) are subordinate to DEP-IO and IDENT-IO[weight]. ALIGN-FT-L is ranked below MAX-IO. In effect, these rankings guarantee that all and only the segments in the input and the weight associated with them are realized in the output. As we have already established the rankings between these markedness constraints and the BT-Faith constraints in (16), we can expand our constraint ranking by transitivity. The overall ranking of the constraints involved in child Japanese truncation can be summarized as below.

(24) The emergence of the unmarked ranking in child Japanese truncation



In the constraint ranking above, each markedness constraint stands between at least one higher IO-Faith constraint and one lower BT-Identity constraint. In other words, the ranking in (24) is an instantiation of the emergence of the unmarked schematized in (4).

4.3 Prosodic faithfulness

In this section, I will provide further supportive arguments for BT-Identity by demonstrating prosodically-sensitive faithfulness between the truncated form and its base. The line of reasoning I follow here is the one taken in McCarthy (1995), Benua (1995) and Itô, Kitagawa and Mester (1996). When two representations exhibit correspondence which make reference to their full prosodic organization, both are output representations. This follows from the standard conception of prosodic theory that only outputs have a fully reliable representation of prosodic structure, including that of higher constituents. Thus if a truncated form shows identity effects with a corresponding form in terms of their syllable-, foot- or word-structure, that corresponding representation must be an output representation as well.

There are two types of prosodic identity effects that can be found in the child Japanese truncation data: the first makes reference to foot structure, and the second to syllable structure. The evidence for these effects comes from the preservation pattern of syllables predictable from the prosodic organization of the target words. The basic mapping relation between target words and their truncated forms, summarized in (7), is repeated here as (25) with additional examples.

(25) a. **...H_i...L...** -> **H_iL**
ex. ʃoo.boo.ʃa (HHL) -> booʃa (HL) 'fire engine'
ji.doo.ʃa (LHL) ->doo.Sa (HL) 'automobile'
em.pi.tu (HLL) -> em.pi (HL) 'pencil'
men.so.ree.ta.mu (HLHLL) -> men.so (HL) 'mentholatum™'
b. **...H_i...(no L)** -> **H_i**
ex. ki.kai (LH) -> kai (H) 'high'
ip.pai (HH) -> pai (H) 'a lot'
c. **L_iLL...** -> **H_iL**
ex. tamago (LLL) -> taama (H) 'egg'

As shown in (25a-b), when the target contains at least one heavy syllable, the truncated form preserves this syllable. When there are no heavy syllables in the target, a light syllable is made heavy in the truncated form, as can be seen in the LLL case (25c). The syllable in an LLL target which is preserved and undergoes this process is always the initial syllable. Thus we do not find the following hypothetical truncated words:

(26)

Adult target	Impossible truncation	Meaning
ta.ma.go	*maa.go	egg
ra.ji.o	*jii.o	radio
ku.ru.ma	*rum.ma, *ruu.ma	car

What the heavy syllables in (25a-b) and the initial light syllable in (25c) have in common is their particular position within the feet. Following Itô and Mester (1992), I assume that in the surface representations of Japanese words, bimoraic feet are left-aligned unless they disrupt syllable integrity. The target base words in (25) are therefore parsed as in the left column of (27) below.

(27)

	Base	Truncated form
a.	(**ta**.ma.)go, (**ra**.ji.)o, (**ku**.ru.)ma	(**ta**a.)ma, (**ra**a.)ji, (**ku**m.)ma
b.	ji.(**do**o.)ʃa, (**e**m.)(**pi**.tu), ki.(**ka**i)	(**do**o.)ʃa, (**e**m.)pi, (**ka**i)

Each underlined element in (27) is the head of a foot, which is the first mora in a bimoraic trochee. The mapping pattern therefore shows that the foot-head in the truncated form must correspond to a foot-head in the base form. This prosodic faithfulness effect can be captured by O-ANCHOR-POS, one of the four main types of ANCHOR constraints in the reformulated version of Anchoring in McCarthy (to appear). O-ANCHOR-POS requires that a segment's constituent-internal position be conserved under correspondence from S_2 to S_1. The specific formulation of O-ANCHOR-POS relevant here is given in (28).

(28) 'ANCHOR-FTHEAD' = O-ANCHOR-POS_{BT}(Ft, Ft, Head)
If a foot-head in the truncated form has a correspondent in the base, then the correspondent is a foot-head.

The effects of ANCHOR-FTHEAD is illustrated in (29) where candidates (a) and (b) both satisfy the condition imposed by the markedness constraints discussed in Section 3.1.

(29) ANCHOR-FTHEAD

Base: $(ta_1ma_2)go$	FTBIN, ALIGN-FT-L, UNARITY(FT)	ANCHOR-FT-HEAD
a. $(ma_2a)go$		*!
b. ☞ $(ta_1a)ma$		

In (a), the head of the foot in the truncated form has a correspondent in the base, but the correspondent is not a foot-head element. In the optimal candidate (b), the foot-head in the truncated form corresponds to the foot-head in the base. In effect, ANCHOR-FTHEAD, ensures that the head of one of the feet in the base is preserved as the head of the foot in the truncated output.[10]

The mapping pattern HH -> H indicates, however, that ANCHOR-FTHEAD cannot account for all the prosodic identity effects. Recall that the ranking of FTBIN, ALIGN-FT-L and UNARITY(FT) above MAX-BT and IDENT-BT[weight] does not predict the truncation pattern of the HH targets.

(30) FTBIN, ALIGN-FT-L, UNARITY(FT) >> MAX-BT, IDENT-BT[weight]

Base: (ip)(pai) 'a lot'	FTBIN, ALIGN-FT-L, UNARITY(FT)	MAXBT	IDENT-BT[weight]	ANCHOR-FTHEAD
a. (ip)(pai)	*(ALIGN)			
b. ✖ (ip)pa		*		
c. ☞ (pai)		*		

In (30), the undesirable candidate (b) ties in the evaluation with the optimal candidate (c). ANCHOR-FTHEAD does not differentiate (c) from (b), since in both candidates the head of the foot in the truncated output properly corresponds to a foot-head in the base. In comparing the truncation pattern of HH targets (HH -> H) to that of HLL targets (HLL -> HL, e.g., *eNpitu* -> *eNpi*), we notice that the relevant prosodic constituent is the syllable.

(31)

ippai -> pai (*ippa)	Syllable 1	Syllable 2
Base:	ip	pai
Truncated form: (b)	ip	*pa
(c)	Ø	pai

Cf. eNpitu -> eNpi	Syllable 1	Syllable 2	Syllable 3
Base:	eN	pi	tu
Truncated form:	eN	pi	Ø

The pattern in (31) shows that a syllable-final element in the truncated form must have a correspondent in the base that is also syllable-final. This requirement too can be expressed as an O-ANCHOR-POS constraint, whose exact characterization is given below.

(32) 'ANCHOR-σ-R' = O-ANCHOR-POS$_{BT}$ (σ, σ, R)
If a syllable-final element in the truncated form has a correspondent in the base, then the correspondent is syllable-final.

Now we also have an explanation for the LH -> H mapping, which we left unanswered in Section 4.1. The problem with the rival candidate (a) in (33) is that it

[10] Although there is a robust tendency in early word truncation to preserve the stressed syllable (Echols and Newport 1992, Fikkert 1994, Gerken 1994, Wijnen, Krikhaar, and den Os 1994), it has been difficult to determine whether the preservation pattern simply reflects the perceptual salience of stressed syllables or prosodic faithfulness effects based on foot structure (see Demuth 1996 and Pater 1996). Since Japanese lacks stress, the child Japanese data provide independent evidence for prosodic faithfulness in child truncation.

violates the prosodic identity constraints ANCHOR-FTHEAD and ANCHOR-σ-R. Either constraint would thus exclude (b).

(33) ANCHOR-FTHEAD and ANCHOR-σ-R

Base: ki(<u>k</u>ai)	FTBIN, ALIGN-FT-L, UNARITY(FT)	ANCHOR-FTHEAD	ANCHOR-σ-R
a. (kii)<u>k</u>a		*!	*(!)
b. ☞ (<u>k</u>ai)			

To sum up this section, I have shown that the truncated forms exhibit prosodic faithfulness effects with their target words. The two identity effects observed in the data are sensitive to foot structure and syllable structure. Since prosodic identity holds only between output representations, these observations provide strong evidence that the truncated form is in correspondence with the base output. This gives further support to the arguments developed in the two preceding sections in which we posited that the faithfulness constraints whose effects yield to the demands of the markedness constraints (FTBIN, ALIGN-FT-L and UNARITY) are constraints on correspondence between two output representations.

5. Conclusion

In this paper, I have examined Japanese children's word truncation around the age of 2 years. I have argued that this phenomenon is a case of the emergence of the unmarked. The pattern of truncation exhibits clear templatic effects, which restrict the prosodic shape and size of the truncated forms. Yet these restrictions do not dictate the child's phonological system in its entirety. Furthermore, the truncated forms are seen to mimic the prosodic organization of the target words. This state of affairs can be explained in terms of an interaction between a set of prosodic markedness constraints and two distinct sets of faithfulness constraints, one that regulates input-output correspondence (IO-Faith), and another that regulates the correspondence between the truncated form and its base output (BT-Identity). Since the effects of the markedness constraints are only visible in the truncated outputs, they must be ranked between IO-Faithfulness and BT-Identity, dominating only the latter. As a result, the child's grammar exhibits the emergence of the unmarked.

A question which has not been addressed in this study is: What is the relation of this stage of child grammar to adult grammar? One simple answer to this question is that the stage reflects a transitional ranking of constraints which stands between the initial state and the end-state. Nevertheless, the set of markedness constraints involved in the child truncation phenomenon are strikingly similar to those that participate in the adult systems of truncation. It has been proposed that constraints on correspondence can be parochial to specific sub-domains of morphology (Urbanczyk 1995, Benua 1995). This means that each type of morphological truncation in adult Japanese has its own set of correspondence constraints. The constraints that govern truncation in child Japanese may then be of the most general types, which will eventually divide into many sets of correspondence constraints, each associated with a particular operation of truncation, e.g. Max-BT (hypocoristics), Max-BT (loanword clipping), etc.

Multi-dimensional markedness follows from the basic tenets of OT: namely, ranking of constraints, violation under domination and correspondence between grammatically-related representations (McCarthy and Prince 1994). Thus, demonstration of the emergence of the unmarked in a child language provides evidence that these properties of OT are already present in the non-steady-state grammar, lending support to the idea that such characteristics are inherent to the human language. Conversely, the OT conception of markedness sheds new light on our understanding of child phonology. Previous OT-based studies of early phonology have shown that the prevalence of unmarked structure in early word production can be explained by positing an initial-state ranking in which markedness constraints outrank faithfulness constraints (Demuth 1995, Gnanadesikan 1995, Pater 1996). This study shows that a more complicated role of markedness in early phonology also receives a natural account if we credit the developing grammar with the same mechanism that has been proposed to underlie mature systems.

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