

PHONOLOGY–MORPHOLOGY INTERFACE: TYPICAL VS. ATYPICAL DEVELOPMENT OF HEBREW*

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1 Introduction

A major characteristic of atypical language development is a deviation from one or more typical patterns, often in addition to a delay in the development. Bat-El (2009) proposed that some deviant phonological phenomena can be accounted for by asynchronization between layers of word's representation (i.e. syllable, foot, segments, etc.), where the development of one layer lags behind that of the other. In this paper, we introduce another deviant phenomenon in atypical development, which we attribute to asynchronization between phonological and morphological development.

We compare two Hebrew-acquiring boys, examining the interaction between the production of the plural verb suffix *-ím* (morphology) and word final codas (phonology). We do so in light of the Prosodic Licensing Hypothesis (Lleó 2003, Demuth 2007, Demuth and McCullough 2008), according to which children are more likely to produce grammatical morphemes in prosodically licensed positions. We adopt a narrower interpretation of the hypothesis, stating that the acquisition of prosodic structure *S* is a prerequisite for the acquisition of the grammatical morpheme hosted by *S*. That is, the production of *-ím*, as in *kam-ím* 'to get up MS.PL.PRES' and *potχ-ím* 'to open MS.PL.PRES', requires a prior acquisition of word final codas.

The two boys we study here, IM and YV, differ from each other in the pace of language development, with YV being much slower than IM. Assuming the Prosodic Licensing Hypothesis, one would expect that a slow development of final codas (prosodic structure) would postpone the

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emergence of the suffix *-im* (grammatical morpheme). However, our data suggest that this is not necessarily the case, as YV's morphology advances despite the limited prosodic structure.

Like other Hebrew-acquiring children (Bat-El 2012), IM started producing verbs with *-ím* after acquiring final codas in morphologically simple forms. Such a development demonstrates synchronization between phonology (codas) and morphology (*-im*). YV crucially differed from IM, as he started producing verbs with *-ím* before acquiring final codas in morphologically simple forms; consequently, coda faithfulness in verbs with *-im* was much higher than in bare stems of both nouns and verbs. For example, while *adóm* 'red' was produced as *adó*, i.e. without a coda, the verb *kam-ím* 'to get up MS.PL.PRES' was produced with a coda. Note that both children did not delete the coda of the suffix; we will address this issue in §5.

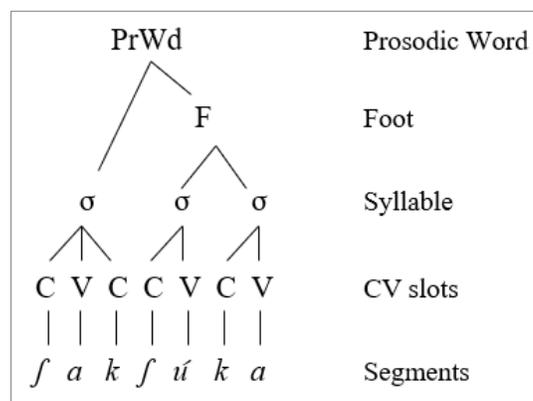
YV's development did not comply with the Prosodic Licensing Hypothesis as stated above, as he did not acquire the prosodic structure hosting the suffix *-im* before starting producing it. By not complying with the Prosodic Licensing Hypothesis, YV's development was asynchronized and thus deviant. That is, YV's language development was not only slow but also atypical.¹

The paper is organized as follows. As a background, we briefly review phonology-morphology interface in acquisition with reference to the Prosodic Licensing Hypothesis and the concept of synchronization (§2). Then, we turn to our study, starting with the methodology (§3), and continuing with the data that reflects the substantial pace gap between the two boys (§4). Finally, we turn to the phonology-morphology interaction with reference to the development of *-im* and final codas (§5) and provide a formal analysis within the framework of Optimality Theory (§6). We then close with concluding remarks (§7).

2 Prosody-Morphology Interface in Acquisition

In the course of language development, prosodic units are acquired gradually, syllables grow from CV to CVC and prosodic words grow from one to two and then three syllables (Demuth and Fee 1995). Each of these units resides on an independent level in the prosodic hierarchy in (1), which assigns the prosodic structure of the word, and hosts the segmental content at the bottom of the word structure.

- (1) The prosodic hierarchy (Selkirk 1980, Nespor and Vogel 1986)



¹ We adopt a narrow interpretation of “atypical” development (relative to clinical interpretation), whereby slow development is not considered atypical as long as its only characteristic is being slow (see §2).

Morphology, in turn, emerges when phonology is at least partially acquired. Children acquiring Hebrew (Armon-Lotem and Berman 2003), as well as those acquiring English (Radford 1990) and Sesotho (Demuth 1994), start with stem-like productions, i.e. words without overt morphological structure. For example, *fal* corresponds phonologically to the target *nafál* ‘to fall 3.MS.SG.PAST’, but during the stem-like phase it also corresponds to other forms in the paradigm, such as *nafláti* ‘to fall 1.SG.PAST’ and *naflá* ‘to fall 3.FM.SG.PAST’. As argued in Adam and Bat-El (2008b), stem-like forms during early speech indicate the presence of morphological knowledge, but the surface manifestation of the morphologically complex forms is blocked by the phonological system. This period of time, when stem-like forms are produced, allows the children to acquire phonological structure, including what is necessary for morphological structure.

Morphology not only emerges after some phonological structure is acquired, but is also contingent upon phonological development, in particular prosodic. This is in accordance with Prosodic Licensing (Itó 1986, 1989) which “requires that all phonological units belong to a higher prosodic structure” (Itó 1989:220). That is, with reference to the prosodic hierarchy in (1), segments belong to a higher prosodic unit. Affixes, and grammatical morphemes in general, consist of segmental elements (in most cases), which must be prosodically licensed, i.e. belong to a prosodic unit. In the context of language acquisition, this is known as the Prosodic Licensing Hypothesis (Demuth 2007, Lleó 2003), according to which the prosodic structure hosting a grammatical morpheme is a prerequisite for the production of the morpheme.

Typically developing children respect Prosodic Licensing via avoidance – they do not produce the affix until they acquire the prosodic structure required for hosting the affix. For example, the 3rd person singular verb suffix *-s* in English is first produced with vowel-final stems (e.g. *sees*), and only later with consonant-final stems (e.g. *needs*); that is, *-s* is produced only when the required coda structure is acquired – first simple codas and then complex codas (Song et al. 2009). In Spanish, the developmental pace of the plural *-s* correlates with the pace of coda production in stems (Lleó 2006). In Sesotho, proclitic are first produced with monosyllabic stems, and only later, when the restrictions on word size permit, with polysyllabic stems (Demuth 1994). In Hebrew, children produce the plural verb suffix *-im* only after acquiring final codas, to the extent that the pace of coda development may affect the order at which the affixes appear in the child’s productions (Bat-El 2012).

However, contrary to the above examples, the plural suffix *-f* in European Portuguese is typically produced before final codas in bare stems; for example, the coda in *bɔlv-f* ‘balls’ is produced before the coda in *lɛpif* ‘pencil’ (Freitas et al. 2001). Thus, while in Hebrew the suffix is produced after final codas are acquired, in European Portuguese it goes the other way around. This difference is attributed to frequency (Bat-El 2012); while the frequency of codas in Portuguese is ~14% (Vigário et al. 2006), that of Hebrew is ~45% (Asherov and Bat-El 2019). Thus, children acquiring European Portuguese do not have sufficient input to promote the production of codas, until they get to the morphological markers, which have a grammatical function.

In light of the early literature, it seems that phonological and morphological development synchronize in a particular way, with prosodic licensing being a governing factor in the synchronization. However, language specific factors may interact with the expected synchronization, as in the case of European Portuguese.

Building on Grunwell’s (1982, 1989) ‘chronological mismatch’, the notion of synchronization in acquisition is based on the difference between typical and atypical phonological development; in particular, on the persistence of early phonological processes in atypical development. Bat-El

(2009) proposed that the persistence of one phonological process relative to another indicates asynchronization in the development of the different levels (1). Consonant harmony in long words (3-4 syllables) produced by Hebrew-acquiring dyspraxic children (Tubul-Lavy 2005) has been attributed in Bat-El (2009) to asynchronization between the prosodic word level and the segmental level (e.g. *šokolad* → *lólola* ‘chocolate’). Similarly, the persistence of coda deletion in long words, or the constraint against codas, is attributed to asynchronization between the prosodic word level and the syllable level (e.g. *mixnasáim* → *ixasái* ‘pants’). Asynchronization, whereby the development of one level is slower and thus lags behind the other, leads to deviant phenomena in atypical development.

The case study presented here focuses on asynchronization between two closely related components of grammar – phonology and morphology, more precisely, prosodic phonology and morphology. As noted above, typically developing children use the avoidance strategy to respect Prosodic Licensing, thus avoiding a particular grammatic morpheme until they acquire the prosodic structure that hosts the morpheme. Here we examine the morphological development of a boy with a slow prosodic development.

Given a slow development of a prosodic structure S, we would expect one of the following two paths with regard to morphological structure requiring S:

- a. Morphology is delayed in accordance with the slow prosodic development. That is, phonology and morphology synchronize as in typical development. Such a development is characterized as a *slow development*.
- b. Morphology advances despite the slow prosodic development. That is, phonology and morphology do not synchronize, yielding deviant phenomena. Such a development is characterized as an *atypical development*.

The case study presented here is of an atypically-developing child, whose morphology advances despite his slow prosodic development. The resulting deviant phenomenon is that the prosodic structure in morphologically complex verb forms (stem+suffix) is more advanced than in morphologically simple verb forms (stem).

3 Methodology

The data used in this study are drawn from the early speech of two monolingual Hebrew acquiring boys – YV and IM, with the former exhibiting a slow developmental pace.² The children were recorded on a weekly basis from the beginning of their speech, during one-hour sessions that included spontaneous speech and picture/object naming. Data were transcribed (IPA), coded and analyzed using Child Phonology Analyzer (Gafni 2015). The corpus consists of more than 25,000 tokens for each child.

² YV was diagnosed with mild Pervasive Developmental Disorders (PDD). However, his clinical assessment is not a factor in our study, as there is no one-to-one correlation between a particular clinical pathology and a specific phonological characteristic. See Adam and Bat-El (2008a) and Gishri (2009) for more studies on YV.

(2) The corpus

	<i>Age of first recording</i>	<i>Age of last recording</i>	<i>Number of tokens</i>
YV	1;01:11	3;02:25	25214
IM	0;11:28	2;11:24	27778

Age: Y:MM;DD

Based on the interrelation between lexical and phonological development during early stages of acquisition (Stoel-Gammon 2011), the data were organized into periods of development (Adam and Bat-El 2009). Periods were determined according to the number of cumulative lemmas in the lexicon, where each period corresponds to roughly 50 new lemmas. The table in (3) below provides the period–age correlation for the two children.

(3) Periods of development

<i>Period</i>	<i>Cumulative Lemmas</i>	<i>IM</i>	<i>YV</i>
1	~10	1;01:08	1;03:27
2	~50	1;04:01	1;06:26
3	~100	1;05:07	1;08:28
4	~150	1;06:04	1;10:30
5	~200	1;07:01	1;11:25
6	~250	1;08:04	2;01:22
7	~300	1;08:18	2;02:21
8	~350	1;09:03	2;03:05
9	~400	1;09:17	2;04:23
10	~450	1;10:12	2;05:07
	:	:	:
19	~900	2;03:08	3;02:25

The periods are used as a methodological tool in order to compare between the children on the basis of their development rather than age, which is critical when comparing children who differ to a great extent in their developmental pace. This gap is presented in the following section.

4 YV's Slow Development

A major characteristic of atypical language development is deviation from one or more typical patterns, often in addition to a delay in the development. In order to show the deviation and the delay, we compare throughout the paper between YV – the atypically-developing boy, and IM – the typically-developing one. In this section we provide the data reflecting YV's delay in lexical development (§4.1) and prosodic development (§4.2).

4.1 Lexical Development

We evaluate lexical development on the basis of the correlation between age and the number of lemmas in the lexicon (see the periods in (3)). A comparison between the two boys reveals an increasing age gap in lexical development. At the beginning the gap is small; YV reached 10 lemmas (1st period) about two months after IM, and this is considered normal given that children start speaking at different ages within a range of a few months. However, the gap between the two boys gradually increased; IM had 900 lemmas in his lexicon (19th period) by the age of 2;03:08, while YV reached the same number of lemmas almost a year later, at the age of 3;02:25. Figure 1 plots the children's lexical growth, in terms of lexical periods (i.e. number of lemmas) and age.

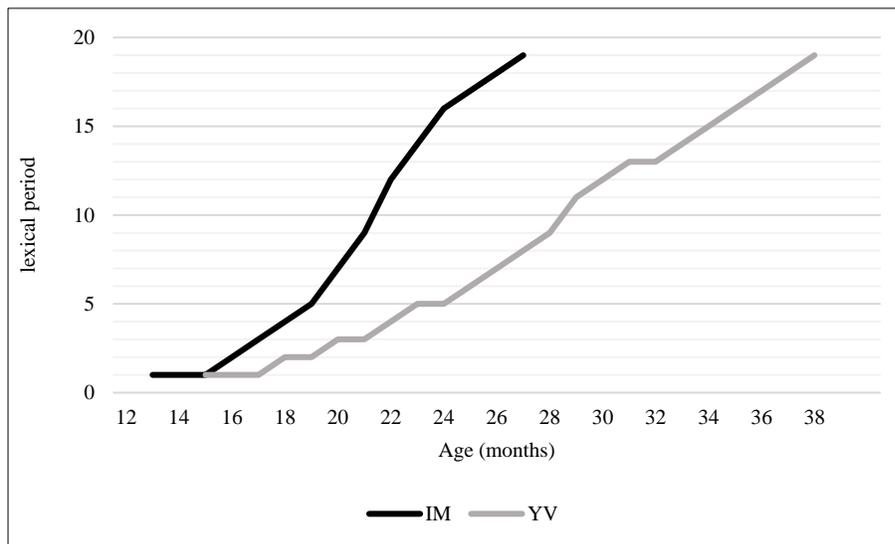


Figure 1: The increasing gap between the boys in lexicon size across age (in months)

As we show in the following subsection, the lexical gap correlates with a phonological gap.

4.2 Prosodic Development

YV's delay is evident not only in his lexical development, but also in his prosodic development. Here we address the development of the syllable with reference to final codas.

At the syllable level, Hebrew-acquiring children start with codaless productions and then proceed to productions with final codas; medial codas appear at a later stage (Ben David 2001, Ben David and Bat-El 2016).

(4) Coda development

	bakbúk 'bottle'	migdál 'tower'
Codaless	babú	midá
Final codas	babúk	midál
All codas	bakbúk	migdál

Figure 2 shows that the two boys followed the same developmental path from no coda to final coda. In terms of lexical periods, the gap was minor, but in terms of age it was notable. YV reached 40% faithful final codas five months after IM, and 80% faithful final codas almost nine months after IM. That is, the development of YV's final codas was slower than that of IM, with an increasing age gap – 5 months at 40% and 9 months at 80%.

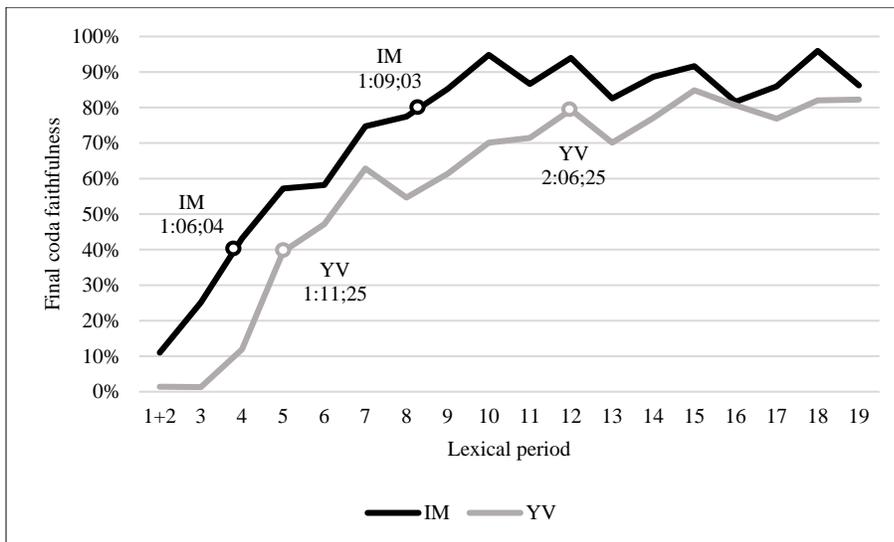


Figure 2 : Percentages of faithfulness to word final codas, with landmarks of 40% and 80%

Note that both children follow the same path of final coda acquisition, but they differ in pace, with YV lagging behind IM in terms of age. Crucially, however, the age gap between the children gradually increases.

We have shown that YV's prosodic developmental trajectory is similar to that of IM in terms of periods, but not in terms of age. This alone could indicate just a slow development, whereby YV lags behind without any qualitative deviation. However, as we show in the subsequent section, YV also displays a deviant phenomenon, attributed to prosody-morphology asynchronization. That is, YV's development was not only slow but also atypical in some aspects (see Adam and Bat-El 2008a for another deviant phenomenon in YV's data).

5 Prosody-Morphology Interface: Plural *-im* and Final Codas

In this section, we present aspects of prosody-morphology interface in the children's inflected verbs, focusing on the masculine plural suffix *-im* found in present tense forms.³ We focus on this suffix not only because it has a final coda but also because it is among the first suffixes to appear

³ The present tense in Hebrew is actually a participle, and the plural suffix *-im* is used also in nouns. However, children use participles mostly for verbs (Berman 1993, Lustigman 2007) and as shown in Handelsman (2020), the suffix *-im* appears in nouns much before it appears in verbs.

in children's speech, and therefore provides an opportunity to explore phonology-morphology interface before phonology is fully acquired.⁴

The segmental structure of *-im* requires a word final coda. However, codas are structurally marked and therefore do not appear during early speech (see §4.2). Typically developing children do not produce *-im* until they are almost entirely faithful to final target codas (Bat-El 2012), as expected by the Prosodic Licensing Hypothesis (§4). They could comply with Prosodic Licensing by deleting the suffix's *m*, thus producing *kobí* instead of *kobím*. However, there are hardly any such forms in our data; affixes are monolithic – they are treated as single units, and are not subject to prosodic manipulation. This supports the claim that the lexical representation of affixes differs from that of stems, as claimed by the theory of Lexical Phonology (Kiparsky 1982).

If YV was just a slow-developing boy, we would expect him to produce *-im* after the acquisition of final codas, like typically developing children; and since he acquired codas late, we would expect him to produce *-im* late as well. However, this was not the case.

Unlike typically developing children, YV produced *-im* when he was not yet faithful to final codas overall. Moreover, he produced the final *m* in the suffixed forms, such that the production of final codas in the suffix was more faithful than in stems. That is, with respect to final codas, the phonology of suffixes was more advanced than the phonology of stems. Our study of the suffix *-ti* suggests that this is actually a contrast between morphologically complex and simple forms (Haim 2020).

Figure 3 below displays final coda faithfulness (repeated from Figure 2), with reference to the acquisition of *-im* (marked with a circle on the graph).⁵ IM, the typically-developing boy, acquired *-im* at the 12th period, when he was highly faithful to final codas (94%), in line with the 90% threshold that was found in Bat-El (2012) with two other typically developing children. YV did not reach 90% coda faithfulness even at the 19th period. Nevertheless, YV produced *-im* at the 8th period, when his faithfulness to final codas was just above chance (55%), not even close to the 90% threshold.

⁴ Note that *-im* often triggers vowel deletion in the stem when it is attached to consonant-final stems, yielding a medial coda (e.g. *kot.vím* 'to write MS.PL.PRES'). Children tend to delete these medial codas when they are still acquiring suffixes, as medial codas are acquired much later than suffixes in general (see §4.2).

⁵ A criterion for suffix acquisition was employed (Bat-El 2012), according to which a suffix is considered acquired if it meets conditions (a) productivity and (b) contiguity:

- a. Productivity: A suffix (S_i) in a suffixed form ($X+S_i$) is considered productive if at least one of the following conditions is met:
 - i. The suffix was produced earlier with a different stem ($Y+S_i$)
 - ii. The stem was produced earlier with no suffix (X)
 - iii. The stem was produced earlier with a different suffix ($X+S_j$)
- b. Contiguity: A suffix (S_i) is considered contiguous if productive productions of (S_i) are no more than one lexical period apart.

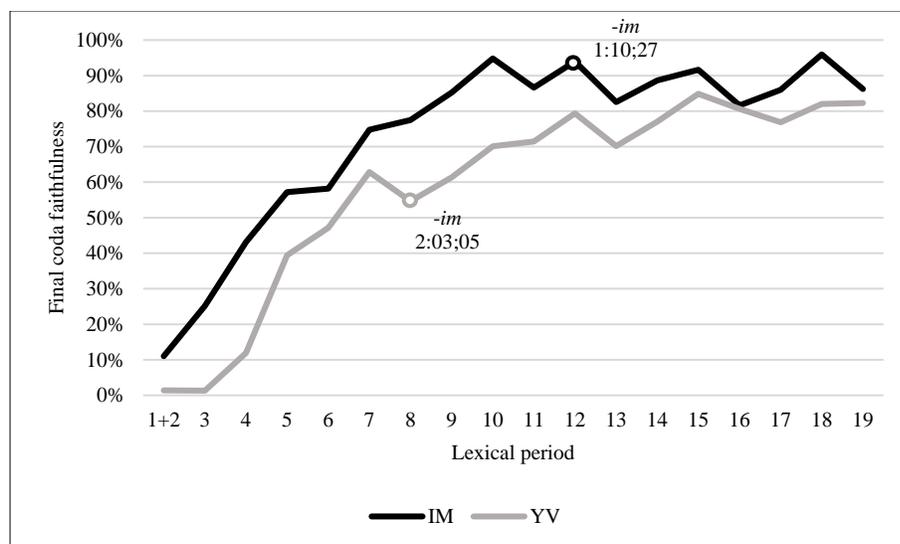


Figure 3: The emergence of *-im* with reference to the development of final codas

As shown in (5) below, YV produced almost all codas in the suffixed form, even though his overall faithfulness to final codas was much lower. In other words, YV's morphology advanced despite his slow development of final codas. IM, the typically developing boy, was almost entirely faithful to codas in *-im* as well, but this is expected; he has already acquired final codas (around 90%) and thus his phonology allowed him to be faithful to the final codas in the suffix. That is, while IM complied with the Prosodic Licensing Hypothesis, YV did not. The table in (5) presents the percentages of final coda faithfulness in each period, starting from two periods before *-im* was acquired for each child.

(5) Final coda faithfulness (tokens): all targets vs. *-im* targets

Period	IM		YV	
	All targets	<i>-im</i> targets	All targets	<i>-im</i> targets
6			47% (175/371)	
7			62% (176/280)	
8			55% (252/461)	100% (2)
9			61% (437/712)	100% (18)
10	95% (275/290)		70% (326/465)	100% (11)
11	87% (266/307)		71% (483/676)	100% (11)
12	94% (249/265)	100% (6)	79% (612/771)	100% (7)
13	83% (161/195)	100% (2)	70% (486/693)	91% (10/11)
14	89% (414/467)	100% (4)	77% (665/863)	100% (1)
15	92% (318/347)	100% (8)	85% (1250/1473)	98% (48/49)
16	82% (213/261)	100% (7)	81% (732/908)	71% (5/7)
17	86% (276/321)	100% (2)	77% (678/882)	100% (14/14)
18	96% (546/569)	89% (8/9)	82% (729/889)	95% (21/22)

It is important to note that the difference shown above cannot be attributed to the acquisition of *m*. As shown in (6), final codas are close to 100% faithfulness in verb targets with *-im* during all periods, while other forms with final *m* are far behind.

(6) YV's final coda faithfulness (tokens)

Period	<i>-im</i> targets		Final <i>m</i> targets	
6			23%	(13/57)
7			39%	(12/51)
8	100%	(2)	40%	(20/50)
9	100%	(18)	66%	(67/102)
10	100%	(11)	84%	(56/67)
11	100%	(11)	91%	(103/113)
12	100%	(7)	94%	(162/172)
13	91%	(10/11)	88%	(84/95)
14	100%	(1)	96%	(141/147)
15	98%	(48/49)	99%	(313/317)

In (7) below we provide a few examples which show that within the same period, verbs with the suffix *-im* preserved final codas, while final *m* in other words was not preserved.

(7) YV's productions for final *m* targets (9th period)

Verb targets with <i>-im</i>			Other targets with final <i>m</i>		
Output	Target		Output	Target	
osím	osím	'to do MS.PL.PRES'	kató	katóm	'orange'
χím	holým	'to walk MS.PL.PRES'	ná	jám	'sea'
sí:m	nosím	'to drive MS.PL.PRES'	χú	χúm	'brown'
χím	tsoxakím	'to laugh MS.PL.PRES'	tái	ftáim	'two'
akím	mesaxkím	'to play MS.PL.PRES'	taí	taím	'tasty'
oxím	oxlím	'to eat MS.PL.PRES'	tá?i	metsiltáim	'cymbals'
atí:m	footím	'to drink MS.PL.PRES'	fái	miʃkafáim	'glasses'

6 Prosody-Morphology (A)synchronization

The findings presented above indicate a fundamental difference between the two boys in the prosody-morphology interface. The typically developing boy was prosodically ready to produce the suffix *-im*, thus synchronizing between the phonological (codas) and morphological (*-im*) development. The atypically developing boy was not prosodically ready to produce the suffix *-im*, but nevertheless started producing it; in our terms, he displayed an asynchronized development.

Figure 4 below illustrates the synchronization between morphology (*-im*) and prosodic phonology (codas) in IM's development, and the asynchronization in YV's development. The shaded area marks YV's asynchronization phase, during which he displayed *split prosodic phonology*, distinguishing between morphologically simple and complex forms; codas in complex forms, i.e. verbs with *-im*, enjoyed a high degree of faithfulness (almost 100%), while codas in simple forms were much less faithful (55% in the 8th period increasing to 85% at most in the 15th period).

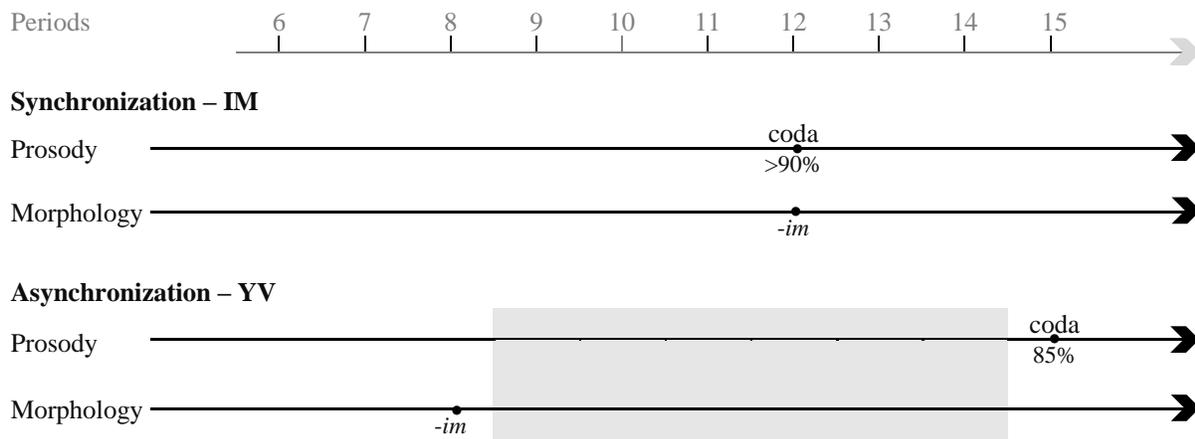


Figure 4: Schematic view of prosody (coda) and morphology (-im) synchronization and asynchronization with reference to periods of development.

YV's development is similar to that of typically-developing children acquiring European Portuguese, who produce final codas in complex words with the plural suffix *-l* before final codas in simple words (Freitas et al. 2001). However, as noted in §2, there is a crucial difference between Hebrew and European Portuguese, with final codas in Hebrew being much more common than final codas in European Portuguese (Bat-El 2012). We do not expect children acquiring the same language, like IM and YV, to display such a crucial difference, unless one of them is an atypically developing child. Importantly, however, as we show below, both IM and YV display universally possible grammars.

We account for the children's grammars within the framework of Optimality Theory (OT, Prince and Smolensky 1993/2004), manipulating two pairs of constraints – morphological (8)a and phonological (8)b; phonological constraints refer to phonological units only (see (1) above), while morphological constraints include also morphological units (e.g. stem, affix, McCarthy and Prince 1993). In addition, within each pair, the first constraint is a markedness constraint (M) and the second is a faithfulness constraint (F).

(8) Relevant constraints

a. Morphology

- i. *M* ALIGNR(stem) The right edge of the stem is aligned with the right edge of the prosodic word
- ii. *F* FAITH[-im] Every *-im* in the input has an identical correspondent in the output

b. Phonology

- i. *M* NOCODA A syllable does not have a coda
- ii. *F* ANCHORR(ω) A segment at the right edge of the input has a correspondent at the right edge of the output

Two comments are in place here. First, with respect to FAITH[-im], recall that suffixes are monolithic, i.e. they tend to resist prosodic manipulation in acquisition, and therefore *-im* is not

produced as *-i* (§5). We therefore define FAITH[*-im*] not only with the requirement to preserve the suffix, but also to keep it identical to its input. The second comment refers to ALIGNR(stem), which is a morphological markedness constraint, and thus satisfied as long as the final segment is a stem segment, regardless of the final segment in the input (e.g. *adóm* → *adó* ‘red’).

At the initial phase, children’s productions are codaless and suffixless, reflecting the markedness-over-faithfulness bias in language acquisition (Tesar and Smolensky 2000). The ranking of the M-constraint ALIGNR(stem) above the F-constraint FAITH[*-im*] blocks the production of suffixes; and the ranking of the M-constraint NOCODA of above the F-constraint ANCHORR(ω) blocks the production of codas. In typical development (9), final codas start appearing rather early, before the emergence of morphology. Thus, during the intermediate phase, only the phonological constraints undergo reranking, allowing final codas in stems before the emergence of suffixes.⁶ At the final phase, the morphological constraints undergo reranking as well, and both morphologically simple and complex words, i.e. both *χolém* ‘to dream 3.MS.SG.PAST’ and *noflím* ‘to fall MS.PL.PAST’ respectfully, are faithfully produced with respect to final codas in stems and in *-im*.

(9) Typical development (IM): Phonology (codas) before morphology (*-im*)

<i>Phase</i>	<i>Morphology</i>	<i>Phonology</i>	‘he dreams’	‘they fall’
Initial	ALIGNR » FAITH[<i>-im</i>]	NOCODA » ANCHORR	<i>χolé</i>	—
Intermediate	ALIGNR » FAITH[<i>-im</i>]	ANCHORR » NOCODA	<i>χolém</i>	—
Final	FAITH[<i>-im</i>] » ALIGNR	ANCHORR » NOCODA	<i>χolém</i>	<i>noflím</i>

The atypically developing boy exhibited slow phonological development, where the ranking of the phonological constraint NOCODA » ANCHORR “got stuck”, while the morphological pair of constraints underwent reranking (10). Thus, for this boy, the intermediate phase consists of bare stems without codas (NOCODA » ANCHORR), as in the initial phase, but verbs with suffixes (FAITH[*-im*] » ALIGNR), as in the final phase.

(10) Atypical development (YV): Morphology (*-im*) before Phonology (codas)

<i>Phase</i>	<i>Morphology</i>	<i>Phonology</i>	‘he dreams’	‘they fall’
Initial	ALIGNR » FAITH[<i>-im</i>]	NOCODA » ANCHORR	<i>χolé</i>	—
Intermediate:	FAITH[<i>-im</i>] » ALIGNR	NOCODA » ANCHORR	<i>χolé</i>	<i>noflím</i>
Final	FAITH[<i>-im</i>] » ALIGNR	ANCHORR » NOCODA	<i>χolém</i>	<i>noflím</i>

In what follows, we present tableaux for two phases of development, the initial (11) and the intermediate (12), where for each phase one tableau is for bare stems and the other for suffixed forms. However, before presenting the tableaux we need to clarify a few points.

We limit the candidates to those relevant to our argument. Thus, for the bare stem we consider two candidates, one with a final coda and another without a final coda; that is, the candidates of the input *χolem* are *χolém* and *χolé*. For the suffixed form we consider one faithful complex form and two bare stems; that is, the candidates for the input *nofel-im* are *noflím*, *nofél*, and *nofé*. We ignore the absence of medial codas during these phases, and thus use *noflím* instead of the actual

⁶ Reranking is gradual, allowing for transitional periods during which intra-child variation is encountered. Here we abstract away from variation and thus do not attend to stochastic models of development.

candidate *nofim*. Notice that we deviate from a common practice to use adults' output for the children's input because we focus here on an inflectional paradigm. As argued in Adam and Bat-El (2008b), children have access to word internal morphological structure even before the emergence of the morphological paradigm in their speech (see §2), and thus the adults' output serves as the children's target word but not as an input. We also abstract away from the morpho-phonological alternation generated by a rule of vowel deletion (e.g. *nofel-im* → *noflím* 'to fall MS.PL.PAST', *kone-im* → *koním* 'to buy MS.PL.PAST'), which is applied without errors by most children, including YV. And because the child's input is the adult's input (e.g. *kone-im*) and not the adult's output (e.g. *konim*), we do not consider here candidates where the suffix is stripped off the adult's output (e.g. *kon*) – they have no chance to win under any ranking.

For the initial phase, we assume the markedness-over-faithfulness bias (Tesar and Smolensky 2000), whereby every M-constraint is ranked above its F-constraint counterpart. In addition, the morphological M-constraint ALIGNR(s) is undominated, as there are no suffixes at this phase.

(11) Initial phase: ALIGNR » FAITH[-im] » NOCODA » ANCHORR

		Morph-M	Morph-F	Phon-M	Phon-F
Bare stem	/χolem/	ALIGNR(s)	FAITH[-im]	NOCODA	ANCHORR(ω)
	χolém			*!	
	Ⓢ χolé				*
Suffixed form	/nofel-im/	ALIGNR(s)	FAITH[-im]	NOCODA	ANCHORR(ω)
	noflím	*!		*	
	nofél		*	*!	**
	Ⓢ nofé		*		***

The difference between the two boys arises in the following intermediate phase (12). In typical development (12), demotion occurs in phonology – NOCODA is demoted below its faithfulness counterpart ANCHORR(ω); while in atypical development (12), demotion occurs in morphology – ALIGNR(s) is demoted below its faithfulness counterpart FAITH[-im].

(12) Intermediate phase

a. Typical development (IM): ALIGNR » FAITH[-im] » ANCHORR » NOCODA

		Morph-M	Morph-F	Phon-F	Phon-M
Bare stem	/χolém/	ALIGNR(s)	FAITH[-im]	ANCHORR(ω)	NOCODA
	Ⓢ χolém				*
	χolé			*!	
Suffixed form	/nofel-im/	ALIGNR(s)	FAITH[-im]	ANCHORR(ω)	NOCODA
	noflím	*!			*
	Ⓢ nofél		*	**	*
	nofé		*	***!	

b. Atypical development (YV): **FAITH[-im]** » **ALIGNR** » **NOCODA** » **ANCHORR**

		<i>Morph-F</i>	<i>Morph-M</i>	<i>Phon-M</i>	<i>Phon-F</i>
Bare stem	/χolem/	FAITH[-im]	ALIGNR(s)	NOCODA	ANCHORR(ω)
	χolém			*!	
	[Ⓢ] χolé				*
Suffixed form	/nofel-im/	FAITH[-im]	ALIGNR(s)	NOCODA	ANCHORR(ω)
	[Ⓢ] noflím		*	*	
	nofél	*!		*	**
	nofé	*!	*	*	***

7 Conclusions

The phonological principle of Prosodic Licensing, which “requires all phonological units belong to a higher prosodic structure” (Itó 1989:220), leads to the Prosodic Licensing Hypothesis in language acquisition (Demuth 2007, Lleó 2003), according to which affixes are produced only after the hosting prosodic structure is acquired. In this paper we showed that this is true for the typically developing Hebrew-acquiring boy, but not for the atypically developing boy.

However, due to the monolithic status of affixes, represented in the analysis by FAITH[-im] (8), the atypically developing boy was faithful to the coda in *-im* (almost 100%), but not to the coda in stems (55%–85%). That is, the coda of the suffix has a prosodic host, without which it cannot be produced (thus respecting Prosodic Licensing), but this host has not been acquired prior to the suffix (contrary to the Prosodic Licensing Hypothesis), but rather only for the suffix.

Consequently, the atypically developing boy exhibits a phase of asynchronization between prosodic phonology and morphology, where morphology emerges before prosodic phonology is ready and thus suffixes are more faithful than stems with respect to final codas.

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