The Ultimate Test: Stress-Conditioned Stress Shift in English L2 Learners

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Abstract

Stress assignment conditioned by stress-shifting suffixes is challenging to L2 learners. However, these suffixes and their shifting patterns have not been studied systematically. The present study aims to investigate the learning processes of these suffixes in L2 production. Twenty Mandarin speakers participated in producing derivatives originated from real and pseudo words. Real derivatives were found to be easier than pseudo derivatives which suggest that frequency plays an important role in the learning process. On the other hand, Pre-stress 1 (stress docks on the immediate left of the suffixes) was found to be easier than Pre-stress 1/2 (stress docks on the immediate left only when it is heavy) pattern. This implies that Pre 1/2 requires the application of Weight-to-Stress-Pattern, which is more demanding for learners. Moreover, the more regular Pre 1 stress pattern may trigger the overgeneralization effect in Pre 1/2 and cause more errors. The strategies learners adopt before fully-acquire English stress patterns are also discussed.

Introduction

1.1 English derivational stress

In English, different suffixes could reassign stem stress in different manners. Neutral suffixes do not reassign stress when attached to stems (e.g. 'comfort – 'comfortable) while non-neutral suffixes, cause reassignment of stress in derivatives. These non-neutral suffixes can be further categorized as Autostress, Pre-stress one (Pre 1), Pre-stress two (Pre 2), and Pre-stress 1/2 (Pre 1/2) (Fudge, 1984). Autostress, regardless of the original stress position in the stem, attracts stress to a particular syllable *in* the suffix. On the other hand, Pre 1, stem stress would be shifted to the syllable immediate left to the suffix (hence the Pre "One" e.g. 'human – hu'manity). The same mechanism works for Pre 2, where stress is always assigned to the syllable second left to the suffix (e.g. 'infant - in'fanticide). Among the non-neutral suffixes, the most complex pattern is Pre 1/2 which assigns stress similarly as Pre 1, (e.g. 'go.vern.ment - go.vern'men.tal, '1L' pattern from now on), but when 1L is weak (CV construct), stress will then dock on the second left syllable to the suffix (e.g. 'origin - o'riginal, 2L from now on).

1.2 Syllable weight and stress assignment

English, as a weight sensitive language, to dock stress on heavy syllable, which could be CVC, CVCC, or CVV in English (Prince, 1990). This pattern is generally referred to as Weight-to-Stress-Principle (WSP). More detailed WSP and metrical rules in English stress assignment can be found in Prince and Hayes's work. In Ou (2005), penultimate syllable (non-suffixed) was manipulated in syllable weight to induce different stress position: (1) penultimate syllable light, stress docks on antepenultimate syllable (2) penultimate syllable heavy, the syllable becomes a foot itself and results in penultimate stress. They found that such pattern is preferred by native English speakers but not by Mandarin speakers. A later subject analysis showed that eight out of twenty Mandarin speakers showed preference on heavy penultimate stress. The results suggest that the L2 learners in their study did not acquire WSP yet. Based on Ou (2005), it is hypothesized that the sense of syllable weight not be challenging for L2 learners, and it is predicted that Pre 1/2 will cast greater challenges to them.

1.3 Neutral and Non-neutral suffixes in L2 production

Based on the review in 1.1 and 1.2, for L2 learners to dock stress on the correct syllable of a derivative, they need to have (1) acquired the suffix stress shifting patterns and (2) have WSP under their belt. Ou (2005) demonstrated that WSP is challenging and wasn't observed in the L2 learners in her study. In terms of the suffix

types, a few studies had attempted to study the effect of suffix to stem stress. Shemshadsara (2011) recorded the production 30 Persian speakers who learn English as L2. The participants produced stems in three conditions: unsuffixed, with neutral suffix and with non-neutral suffix. The study found that words with non-neutral suffixes are significantly harder compared to the other two types.

Park (2011) compared stress assignment in neutral, non-neutral transparent (no stress shift because stem stress happens to coincide with the supposed stress location induced by suffix) and non-neutral opaque (stress shift required) suffixes conditions. The results demonstrated that learners performed significantly better on producing transparent non-neutral derivatives than both neutral and opaque non-neutral. It was surprising that the accuracy of neutral derivatives was worse than non-neutral transparent ones. Park argued that the stress position of neutral derivatives is already unpredictable in the stem, yielding the low accuracy in their derivatives. Such claim is not convincing, as the stress position of non-neutral stems are also unpredictable. However, their results brought up an interesting phenomenon: neutral derivatives do not necessarily induce highest accuracy.

An asymmetry of stress-shift direction preference by L2 learners was found in Lai and Chang (2015). They used different disyllabic foot (trochee or iamb) along with suffix types (stem, neutral, or non-neutral) to induce rightward stress shift (trochaic stem with non-neutral, e.g. 'dictate - dic'tation) and leftward shift (iambic stem with non-neutral suffix, e.g. com'pete - 'competence). Their results showed that rightward shift is easier than leftward shift. The authors discussed the performance was discussed in terms of word frequency effect, wrong analogy of a high frequent derivative lemma, and idiosyncrasy of non-neutral suffixes. Their study provided an advanced viewpoint that neutral and non-neutral categorization is not the only factor at play when it comes to stress reassignment in derivatives.

1.4 The present study

Based on the above-mentioned studies, it is safe to conclude that different non-neutral suffixes casts different levels of difficulties to L2 learners. We are particularly interested in Pre 1/2 suffixes, which requires the learners to have known the stress shift pattern while being sensitive to syllable weight. On the other hand, since non-neutral derivatives can result in two outcomes: 1) stress shift if the stem stress does not coincide with suffix preference; 2) no stress shift if the stem stress coincides with suffix preference, the stress shifting scenario is, not surprisingly, found to be more difficult for L2 learners (Park, 2011). However, Park did not control non-neutral

subtype differences. Pre 1 suffix –ity and Pre 1/2 suffix –ence composed their stimuli, but they have different mechanisms that can possibly mask the results. Also, exceptions of Pre 1/2 were chosen as stimuli in the experiment, which suggests that learners might actually learned the underlying mechanisms but still made errors because they are exceptions. We will be comparing Pre 1 and Pre 1/2 suffixes in how errors are made by L2 learners in both stress shifting and non-shifting scenarios.

Another interesting finding from Lee and Carey (2002) found that Cantonese speakers' strategy of preserving stem vowel quality and stress when they are not aware of the stress shifting nature of suffixed words. They concluded that ESL learners rely mainly on the stem vowel and stem stress pattern when producing unfamiliar derivatives. However, the strategy does not seem to account for the pattern found in Lai and Chang (2015), where learners are more comfortable with rightward stress shift compared to leftward shift. Before fully acquire L2 phonology, learners may adopt strategies that yield production errors. We are interested in exploring the strategies L2 learners adapt during the learning process of derivatives.

To sum up, the present study aims to compare the stress shift patterns between the following factors: (1) real & pseudo words; (2) the effect of stress shift (no shift vs rightward shift); (3) Non-neutral subtypes: Pre 1 vs Pre ½, (4) the role of syllable weight in stress shift in Pre ½: 1L vs 2L. Last but not least, we would like to explore the strategies learners' use when the phonological rules for stress reassignments are not fully learned yet.

Methodology

2.1 Participants

One female native English speaker recorded the stem. Ten male and ten female (19-24 years old; English learning 6-12 years) L2 learners of English who speak Taiwan Mandarin as L1 participated in the read aloud task. None of them reported more than three months of time spent staying in English-spoken countries.

2.2 Stimuli design

The present study focuses on Pre 1 (-ity and -ic) and Pre 1/2 (-al and -an) suffixes. Both real and pseudo words were included as experiment stimuli.

Real words | Pre-stress 1 (-ity & -ic)

No shift σ.σ.'σ - σ.σ.'σ.s		**Rightward shift** σ. 'σ.σ - σ.σ.'σ.s 'σ.σ.σ - σ.σ.'σ.s	
opportune insecure	opportunity insecurity	universe electric popular productive sensitive optimist history electron irony	university electricity popularity productivity sensitivity optimistic historic electronic ironic

Real words | Pre-stress 1/2 (-al & -an)

No shift				**Rightward shift**			
1L σ.'σ.σ - σ.'H.s		**2L** σ.'σ.σ - σ.'σ.L.s		**1L** σ.'σ.σ - σ.σ.'H.s 'σ.σ.σ - σ.σ.'H.s		**2L** 'σ.σ.σ - σ.'σ.L.s	
idea Korea Caucasia	ideal Korean Caucasian	congression emotion profession tradition addition republic Africa India Syria	congressional emotional professional traditional additional republican African Indian Syrian	fundament universe continent accident suicide	fundamental universal continental accidental suicidal	memory industry colony origin Italy history comedy library	memorial industrial colonial original Italian historian comedian librarian

Pseudo words

Five pseudo tokens for each level were made up with careful design of syllable structures. For Pre 1 stems, final syllables were made heavy for non-shifting tokens, and heavy penult or antepenult syllables were made for rightward stress shift. Since stem metrical system is also affected by part of speech, super heavy final syllables for –ic stems were made to ensure extrametricality has as little effect as possible. The tokens conform to English phonotactics. Spellings, which are inconsistent with pronunciations, were avoided (e.g. *mb* codas in real words are mostly most produced with only the bilabial nasal realized and the bilabial stop dropped). All pseudo words were checked by native recorder to ensure that they are pronounceable, English-like, and do not resemble any existing words.

Pseudo words | Pre-stress 1 (-ity & -ic)

No shift L.L.'H – L.L.'H.s		**Rightward shift** 'H.L.H - H.L.'H.s L.'H.H – L.H.'H.s	
pi.la.'gand	pi.la.gan.di.ty	'derk.pa.solf	derk.pa.sol.fi.ty
ni.su.'torf	ni.su.tor.fi.ty	'pern.ri.lant	pern.ri.lan.ti.ty
ke.pi.'bint	ke.pi.bin.ti.ty	'gorn.su.bink	gorn.su.bin.ki.ty
to.ri.'sens	to.ri.sen.si.ty	re.'narp.tunk	re.narp.tun.ki.ty
sa.pi.'rump	sa.pi.rum.pi.ty	ra.'molk.samp	ra.molk.sam.pi.ty
di.pa.'gump	di.pa.gum.pic	'relf.ni.borp	relf.ni.bor.pic
ke.si.'ralp	ke.si.ral.pic	'dolp.se.lind	dolp.se.lin.dic
pa.lu.'dont	pa.lu.don.tic	ma.'suns.delt	ma.suns.del.tic
su.to.'simp	su.to.sim.pic	cu.'ralf.mund	cu.ralf.mun.dic
mo.ne.'pelf	mo.ne.pel.fic	bi.'tork.nalf	bi.tork.nal.fic

Pseudo words | Pre-stress 1/2 (-al & -an)

No shift				**Rightward shift**			
1L L.L.'H – L.L.'H.s		**2L** L.'H.H – L.'H.L.s		**1L** L.'H.H – L.H.'H.s 'H.L.H – H.L.'H.s		**2L** 'H.L.H – 'H.L.L.s	
re.pi.'lonk	re.pi.lon.kal	mo.'link.per	mo.link.pe.ral	de.'garp.sond	de.garp.son.dal	'bon.ta.ruf	bon.ta.ru.fal
ta.lo.'shelp	ta.lo.shel.pal	pra.'colt.min	pra.colt.mi.nal	ro.'jelf.murd	ro.jelf.mur.dal	'tel.mi.pis	tel.mi.pi.sal
bo.mu.'dans	bo.mu.dan.sal	si.'darf.kup	si.darf.ku.pal	'fun.li.gart	fun.li.gar.tal	'las.cu.ten	las.cu.te.nal
fi.li.'dant	fi.li.dan.tal	li.'melp.sod	li.melp.so.dal	'paf.so.bent	paf.so.ben.tal	'ric.ne.sot	ric.ne.so.tal
ka.si.'jimp	ka.si.jim.pal	de.'sump.nat	de.sump.na.tal	'kim.su.pirk	kim.su.pir.kal	'sus.pi.lan	sus.pi.la.nal
ga.po.'nelt	ga.po.nel.tan	chi.'romp.sub	chi.romp.su.ban	si.'ralf.dunt	si.ralf.dun.tan	'sac.me.nof	sac.me.no.fan
si.la.'somp	si.la.som.pan	pro.'zelk.nat	pro.zelk.na.tan	pu.'mel.gwint	pu.mel.gwin.tan	'den.fi.lan	den.fi.la.nan
re.lu.'bilk	re.lu.bil.kan	tu.'bors.jil	tu.bors.ji.lan	'don.si.burt	don.si.bur.tan	'mor.lu.tis	mor.lu.ti.san
o.si.'keld	o.si.kel.dan	re.'malt.pel	re.malt.pe.lan	'nel.to.lark	nel.to.lar.kan	'dim.po.rek	dim.po.re.kan
u.ke.'duns	u.ke.dun.san	ma.'timp.dod	ma.timp.do.dan	'karp.su.femp	karp.su.fem.pan	'cop.sa.dut	cop.sa.du.tan

2.3 Procedure

The participants were asked to sit before a desktop with a headset on and a microphone was set up 15 cm away from to their mouth. There was a practice session, which included 17 real words, and 15 pseudo words before the actual experiment took place. All target tokens (with 2 repetitions) were randomized. The stimuli were presented on a stimulus-presentation system designed to conduct behavior studies. In each trial, a prerecorded stem by a native female speaker was played twice with an interval of 500 ms before the participants were asked to produce the derivative. The spelling and the syllable boundaries of the stem stimuli were presented with stress markers while the derivatives have spelling, syllable boundaries but no stress markers.

The participants were allowed to repeat and correct their own pronunciation until they were comfortable with their production. There is a short break between session, and it took 50-70 minutes for each participant to finish the recording.

2.4 Data Analysis

Data collected from the experiments were rated by two trained phoneticians. The accuracy rate of stress assignment from each token was collected and averaged. We examined the interaction between Word (R for real word and P for pseudo), Suffix (P1 for pre-stress 1 and P1/2 for pre-stress 1/2), Direction (0 for non-shifting and R for rightward-shift). Furthermore, there is another factor only applicable in Pre 1/2 is Weight (1L for stress on heavy presuffixial syllable and 2L for stress repelled to 2L due to light 1L). A 2x2x2 (Word, Suffix, and Direction) repeated measures ANOVA and another 2x2x2 repeated measures ANOVA (Word, Direction and Weight) for Pre 1/2 were conducted.

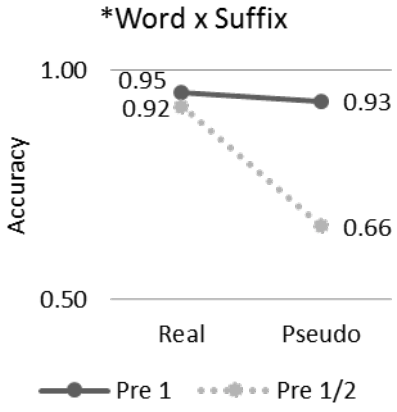
Results

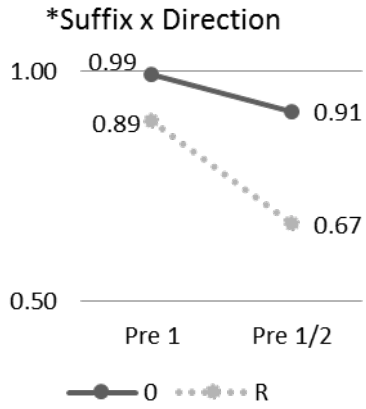
3.1 Overall

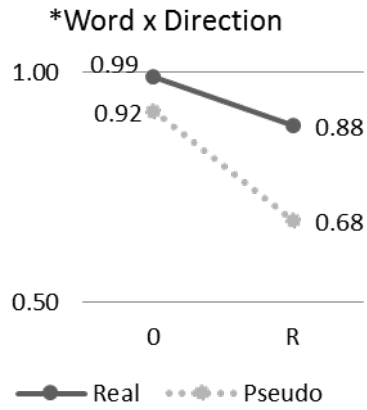
The main effects are all significant in the independent variables we tested: Word [$F(1, 19) = 101.74$, $p < .001$], Suffix [$F(1, 19) = 122.81$, $p < .001$], and Direction [$F(1, 19) = 53.15$, $p < .001$]. The accuracy rate was higher in real words (M = .936, SD = .013) than in pseudo words (M = .798, SD = .010), in Pre 1 (M = .942, SD = .013) than in Pre 1/2 (M = .792, SD = .010), and in no shift (M = .956, SD = .009) than in rightward shift (M = .781, SD = .019).

The interactions of Word x Suffix [$F(1, 19) = 93.84$, $p < .001$], Suffix x Direction [$F(1, 19) = 40.87$, $p < .001$], and Word x Direction [$F(1, 19) = 13.17$, $p = .002$] are all significant as shown in Fig 3.1.1. Pseudo words, rightward stress shift and Pre 1/2 generally have greater effects on lowering accuracy.

Fig 3.1.1. Two-way interactions of Word x Suffix, Suffix x Direction, and Direction x Word

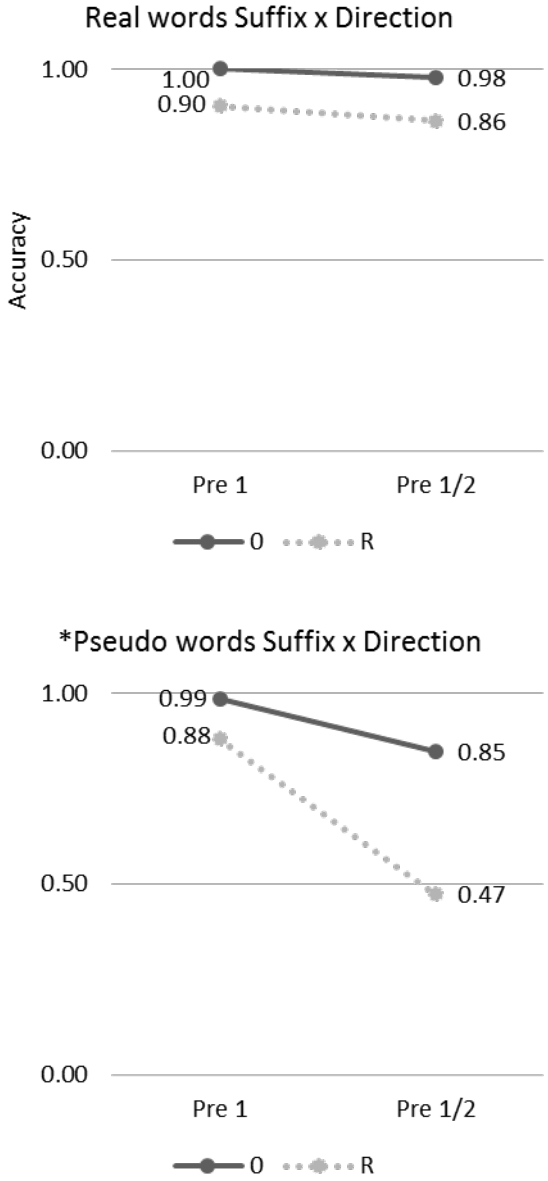






Significance was also found in Word x Suffix x Direction [$F(1, 19) = 30.15$, $p < .001$]. Further 2 x 2 ANOVA shows significance Suffix x Direction for pseudo words [$F(1, 19) = 44.70$, $p < .001$], but not in real words [$F(1, 19) = .713$, $p = .409$] as shown in Fig 3.1.2.

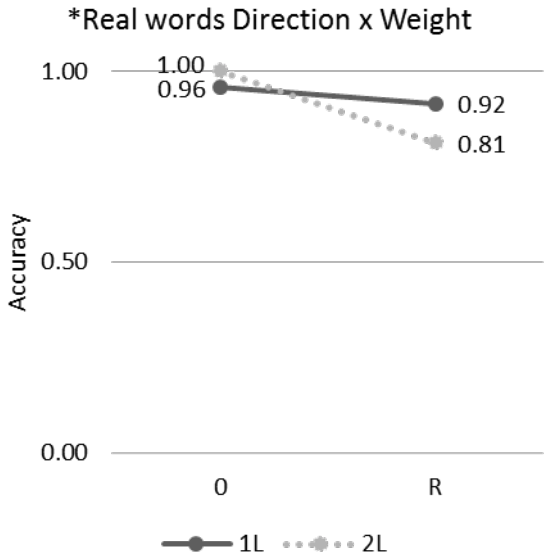
Fig 3.1.2. Three-way interactions of Direction x Word in real words and pseudo words

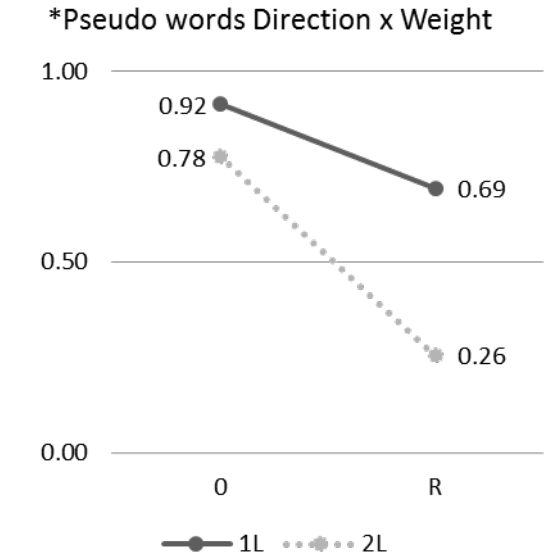


3.2 Pre 1/2

The main effects are all significant in all the independent variables we tested. Word [$F(1, 19) = 135.04$, $p < .001$], Direction [$F(1, 19) = 70.06$, $p < .001$], and Weight [$F(1, 19) = 18.72$, $p < .001$]. Accuracy was higher in real words (M = .922, SD = .017) than in pseudo words (M = .660, SD = .013), in no shift (M = .913, SD = .016) than in rightward shift (M = .669, SD = .019), and in 1L (M = .870, SD = .022) than in 2L (M = .711, SD = .020). Two-way interactions are all significant, Word x Direction [$F(1, 19) = 21.98$, $p < .001$], Word x Weight [$F(1, 19) = 13.90$, $p = .001$], Direction x Weight [$F(1, 19) = 26.74$, $p < .001$]. The effect of Word and Direction resembles that in overall results (see 3.1) and thus is skipped here. The interactions caused by the particular factor only in Pre 1/2, Weight, will be elaborated in thee-way interaction.

The three-way interaction is significant [F(1, 19) = 6.335, p = .021]. Further 2x2 ANOVA shows significant interaction of Direction x Weight in both real [F(1, 19) = 9.46, p = .006] and pseudo words [F(1, 19) = 26.21, p < .001] as shown in Figure 3.2.1. The significant interaction shows that, in real words, rightward shift to 2L syllable is less preferred. Additional pair-T test of the higher 2L accuracy than L1 in no shifts was conducted and showed no significance in difference, suggesting that the interaction is caused mainly due to the worse 2L accuracy in stress shifts. Results from pseudo words rules out learning effect and show clearer picture of the effect of Weight. Stress shift lowers the accuracy, but when the stress is shifted to 2L position, the accuracy drops extremely (M = .255, SD = .218) compared to stress shift to 1L (M = .693, SD = .187).





3.3 Summary for trisyllable results

Overall		**Significance**
	Word	*R>P
	Suffix	*Pre1>Pre1/2
	Direction	*0>R
	Word x Suffix	*PΔ>RΔ
	Suffix x Direction	*Pre1/2Δ>Pre1
	Word x Direction	*PΔ>RΔ
	Word x Suffix x Direction	*
Real words	Suffix x Direction	n.s.
Pseudo words	Suffix x Direction	*Pre1/2Δ>Pre1Δ

Pre1/2		**Significance**
	Word	*R>P
	Direction	*0>R
	Weight	*L1>L2
	Word x Direction	*PΔ>RΔ
	Direction x Weight	*RΔ>0Δ
	Word x Weight	*L2Δ>L1Δ
	Word x Direction x Weight	*
Real words	Direction x Weight	*RΔ>0Δ
Pseudo words	Direction x Weight	*RΔ>0Δ

Discussion

Our general results show that learners performed better in real words, in no stress shift, and in Pre 1 derivatives. The high accuracy rate of real than pseudo derivatives across all other factors suggests that frequency of occurrence plays an important role in learning derivative stress pattern. Compared to Pre 1, Pre 1/2 is believed to be harder to acquire, as speakers are required to apply weight to stress principle (WSP) when assigning new stress in derivative. Although syllable weight in Pre 1/2 stimuli in our experiment was manipulated, learners are found to have higher accuracy for derivatives with stress assigned to 1L than 2L syllables. It suggests that 1L (i.e. presuffixial position) is preferred than 2L syllable in derivatives. We believe the regularity of Pre 1 derivatives or the frequency of the pattern may contribute to the results. Furthermore, the imperfect learning of weight sensitivity among our participants demonstrated that WSP might not be at play in deriving suffixed words echoes the findings in Ou (2005) on unsuffixed words. Lastly, stem stress and the stress of derivatives can coincide (no stress shift) or requires rightward shift. We found rightward shifting derivatives were more problematic than non-shifting ones, which attested that non-neutral opaque derivatives are worse learned than transparent ones (Park, 2011).

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