REFIN(D)ING TURKİSH STRESS AS A MULTIFACETED PHENOMENON

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Refin(d)ing Turkish stress as a multifaceted phenomenon

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1. Objectives

- Much has been said about stress assignment in Turkish, albeit with dubious characterizations of its nature and dynamics in the realm of prosodic typology and psycholinguistics.
- Unpacking the notion of "accent" at the level of the word in light of psycholinguistic, cross-linguistic and diachronic evidence and refine various observations that have been made so far in the literature concerning the nature of word stress in Turkish.
- Psycholinguistic approach towards phonology: Phonology is phonetics plus memory. It deals with the organization of sounds, rhythms and melodies to explore the abstract form of words and constructions as stored in the mental lexicon, and how these forms facilitate articulation and processing.
- Property-driven approach to phonological typology: to characterize the same vs. different ways in which phonological *properties* are employed, rather than to classify *languages* into types (e.g., Hyman, 2009; Hyman, 2012, see also Plank, 2001).

Claims

- Word stress in Turkish, regular final or non-final, has a psycholinguistic reality. It is inert but pervasive, bearing both a lexical and delimitative function, tacked to a relatively poor pitch-based intonational inventory.
- It is futile to assume that Turkish is a pitch-accent language because arguments for pitch-accent require the presence of both *accented* and *accentless* words in the lexicon. Likewise, it is unfeasible to claim that both pitch-accent and stress-accent co-exist in the same grammar to account for different location of accentual prominence within the word.
- Due to morphosyntactic complexity of words in Turkish, accentual phenomena are ultimately intertwined with wordhood and phrasehood, whereby the induction of canonical right-edge stress in language acquisition must be word-based and paradigmatic.
- Word formation and grammaticalization have been the impetus behind the morphophonologization of regular final accentual prominence diachronically, ultimately surmounting words with non-final stress.
- Non-final and final stress are an integral property of wordhood in Turkish, and must be seen as part of the same accentual system for both language acquisition and processing.

2. Turkish stress at the phonology-morphosyntax interface

➢ ***Initial, final, or no stress?***
Scholarly debate on Turkish prosody began as early as the beginning of the 1900s (e.g., Lees' excursus on Turkish stress in his 1961 book). It is generally assumed that two patterns co-exist:

NON-FINAL (LEXICAL) STRESS-ACCENT
FINAL (REGULAR/FIXED/NON-LEXICAL) STRESS-ACCENT

Non-final stress[1]

(1) Stems with lexical accents:

a.	*si**né**ma*	"cinema"	(note: final accent for some speakers)
b.	***Bé**bek*	"Bebek"	(cf. *be**bek*** "baby")
c.	***Bé**bek-te*	'in Bebek"	(cf. *bebek-**te*** "in the baby"

(2) Bound morphemes with accentual specifications:

pre-accenting[2]:

a.	*ço**cuk**-ca*	"childish"	(cf. *çocuk-**luk*** "childhood")
b.	*ço**cuk**=la*	"child=with"	(cf. *çocuk-**ta*** "in the child")

locally accented:

c.	*öğre**n-íyor**-um* learn-prog-1s	"I am learning"	(cf. *öğren-**di-m*** "I learnt")

(3) Adverbs generally have stress on their initial syllable (*doğ**ru*** 'true' vs. ***doğ**ru* 'straight' adv., e.g., Erdal 2009).

Regular final stress

(4) a.	*ta**nı***	"know"
b.	*tanı-**dık***	"acquaintance"
c.	*tanı-dık-**lar***	"acquaintances"
d.	*tanı-dık-lar-**ım***	"my acquaintances"
e.	*tanı-dık-lar-ım-**ız***	"our acquaintances"
f.	*tanı-dık-lar-ım-ız-**dan***	"from our acquaintances" (from Sezer, 1983)

- Leftmost prominence in the presence of multiple prespecified accents:

(5) Stem bears a lexical accent:
*İs**tán**bul-lu-laş-árak* "by being someone from Istanbul"

(6) Leftmost suffix bears a lexical accent:

a. pre-accenting:	*Al**man**-ca-nız=la*	"with your German"
b. locally accented:	*gül-**érek**=de*	"also by laughing"

➢ ***How to represent regular final stress?***

i. **"Prosodic Phonology" approach:** In the absence of lexical accent, stress falls on the rightmost syllable of a Prosodic Word (Kabak & Vogel, 2001). Note that final-stress is not lexical in this approach, but an *emergent* property of words in the morphosyntax-phonology mapping.

ii. **"Top-down"/ Intonational approach:** Recently, what is referred to as words with canonical final stress have been claimed to be *accentless* (Kamali, 2011; Güneş, 2015: 103)—as opposed to words with non-final stress, which are claimed to bear a lexical accent (H*L).

[1] How to represent non-final stress is also controversial. It is assumed to be predictable (akin to the Latin Stress Rule) in a sub-set of words (e.g., Sezer, 1983). See Inkelas (1999) for a metrical, Inkelas & Orgun (2003) for a cophonology approach; Kabak & Vogel (2011) for counter-arguments. I will not go into this issue in this talk.
[2] Some of these so-called pre-accenting suffixes are arguably clitics.

➢ ***Utterance-level prosody or word-level prosody?***

- It has also been observed that "word-level stress" can be modulated by phrasal/ utterance-level tonal phenomena (e.g., Göksel & Güneş, 2013)

- Morphsyntactic complexity of Turkish words:

(7) *Alman-laş-tır-**a**-ma-dık-lar-ımız-dan-mı-sınız?*
German-der-vbl-caus-abil-neg-noml-pl-poss.pl-que-2pl
"Are you one of those whom we could not Germanize?"

- Therefore, sentence-level prosody can be seen inside the "word", yielding alternating stress (e.g., Sebüktekin, 1984; Göksel & Güneş, 2013).

(8) a. *Yor**ul**-mu-yor-lar.* "They aren't getting tired"
get.tired-neg-prog-3pl
b. *Yorul-mu-yor-**lar**, eğlen-iyor-lar-dı* "They weren't getting tired, they were having fun".
get.tired-neg-prog-3pl, have.fun-prog-3pl-pst

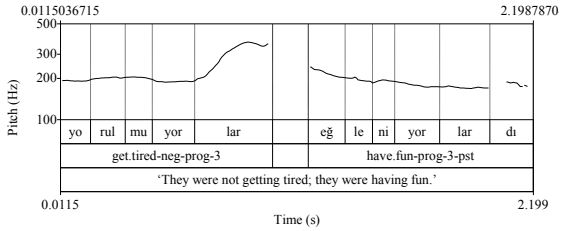

Figure 1: IP boundary tone (H%) overriding lexical accent (from Göksel & Güneş, 2013)

- Göksel and Güneş (2013) argue that the prosody of information and discourse structure configurations works *top-down* and is assigned to *propositions*. This may violate the strict bottom-up structuring of prosody (c.f. the Prosodic Hierarchy, Nespor & Vogel, 1986), providing support for models where word and sentence (phrase) structure mechanisms are not ordered (e.g. Ackema & Neeleman, 2004; Culicover & Jackendoff, 2005).
- ➢ Obviously, intonation (mirroring information structure and pragmatics) may override lexical pitch in Turkish.
- ➢ How information structure interacts with prominence at the morphosyntactic level is poorly studied (see also Özçelik 2014, who discusses a few cases with variable location of stress when two lexically accented morphemes are adjacent).
- ➢ Note that stress can also shift to otherwise unstressable morphological elements in stereotypical stress languages such as English for rhythmic reasons (e.g., the case of iambic reversal-- *THIRteen men* vs. *number thirTEEN*) or due to discourse-pragmatic reasons (*I will INcrease it, not DEcrease*).

Questions

i. What is the nature of accentual prominence at the **word level** in Turkish, psycholinguistically and cross-linguistically?
ii. What are the ramifications of Turkish word-level accent for grammar and *beyond*?
iii. Can answers to these questions shed light on the prosodic typology of Turkish accentual system?

3. Acoustic correlates of "stress" in Turkish

- Common agreement: ***f0* is the most reliable cue** (Konrot 1981, Levi 2005, Pycha 2006, Zora et al. 2016).
- Words with final prominence exhibit a "moderate" rise in *f0* between the first and second syllable in disyllabic words. Words with initial prominence show a fall (Levi 2005, See Figure 2).

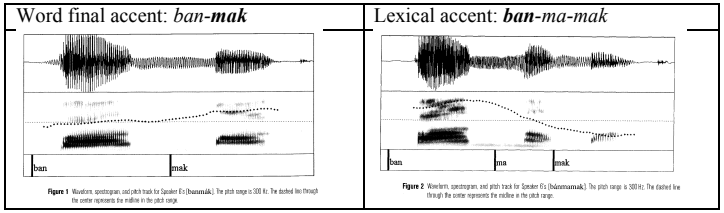

Figure 2: Waveform, spectrogram, and pitch tracks for *banmak* vs. *banmamak*, taken from Levi (2005: 80-81)

- No salient *f0* excursion is observed in word-final prominence, suggesting that *f0* is not a robust cue in that position (Konrot, 1981; Pycha, 2006; Güneş, 2015).
- Not clear what exactly the contribution of other cues such as **intensity, vowel quality (*f2-f1*) and vowel duration** are:
- **Pycha (2006)**: The differences in *f*0, intensity, duration, and vowel quality were all shown to be significant. Since the average differences in intensity and duration between stressed and unstressed syllables were below levels that are perceptually noticable, *f0* is considered to be the most reliable cue.
- **Zora et al. (2016):** The first perception study so far with manipulation of duration, *f0,* intensity and spectral emphasis separately. Duration indeed constitutes an acoustic cue for word stress perception although its lexical status is debatable (Kornfilt 1997, Kabak 2004)

4. Theorizing phonetic evidence: A typology full of (con)fusion

- Levi (2005) argues that Turkish is a pitch-accent language (cf. Underhill 1966) on the basis of the fact that it primarily uses **pitch** for both final and non-final stress (no difference, however, between the two). The other argument she has is CULMINATIVITY, which is however also found in both stress-accent and tone languages (Hyman, 2009, 2012).
- Accented syllables are realized with a **H*+L** pitch accent. When the accent is in final position, the pitch accent is *trimmed* to H* with no fall.

(9) Realization of pitch-accent in Turkish (from Levi, 2002a, b)

ba ba-lar	san dal je
|	| |
H*	H*+L
'father-plural'	'chair'

- **Güneş (2015):** non-final stress is pitch-accent whereas final-stress is stress-accent since the final syllable does not make exhibit *f0* excursion (property of stress-accent).
- **Csató & Johanson (1998); Johanson (1998a):** Stress is realized by a pitch-accent on the final syllable; it is realized by a stress-accent on the non-final syllable.
- **Kamali (2011), Güneş (2015)**: In the *nuclear* position, **words with canonical final accent** retain a plateau throughout with no noteworthy tonal marking on the final syllable (Fig. 3) while **lexically accented words**, via association with H*L, show an early fall starting from the lexical accent until the postnuclear onset. The plateau pattern for words with canonical final stress was also found for words uttered in isolation, as well as those uttered in narrow and broad focus (e.g., Güneş 2013, 2015).
- In the *pre-nuclear* position, items carry a right edge tone, H-, **regardless of whether they are lexically accented** or not (hence H- cannot be an indication of a final accent).
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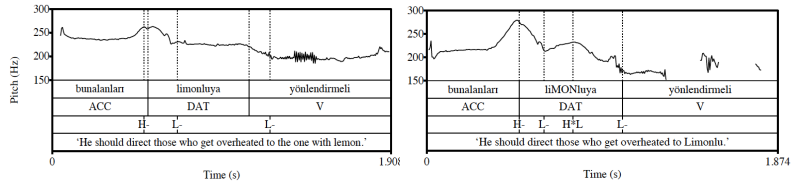


Figure 3: All-new context with a lexically accented (left) and a "regular" (right) word in the nuclear position, affirmative sentence (from Kamali 2013)

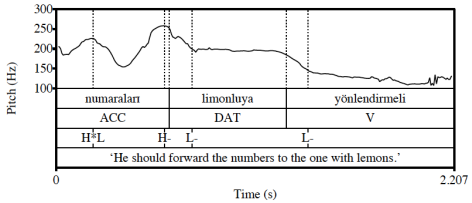


Figure 4: All-new context with lexically accented word in the prenuclear position (*numaraları*), affirmative sentence (from Kamali 2013)

- "[F]inal stress seems to be an *epiphenomenon* at the word level. The perception of finality is possibly a perceptual elsewhere condition, where in fact there is no tonal marking of the relevant syllable." (Kamali, 2011: 109, see also Güneş 2015).

- "Finally stressed" words in Turkish are **accentless words**, which are also attested in Japanese (Pierrehumbert & Beckman, 1988) and varieties of Basque (Hualde et al., 2002).

- Other cues for stress such as intensity, duration and glottal parameters were not investigated in **non-nuclear** positions in Levi's work (or not investigated *at all* in Kamali, 2011), where pitch is known to become irrelevant for **stress** (cf. Sluijter & van Heuven, 1996a, b, see also Kochanski et al., 2005). For example, Gordon (2004) finds that, although useful, *f0* is **subordinate** to duration and intensity as a marker of **word-level stress** in Chickasaw. However, at the **phrase level**, *f0* is the most salient signal of pitch accents (see also Kochanski et al., 2005)

- So, the phonetic evidence is limited and misinterpreted.
- There is no doubt that word-final stress arises as a *default* hence does not need to be stored in the lexicon, but "accentlessness" or "pitch-accent" comes with some typological and empirical consequences:[3]

Consequences/ Predictions of a pitch-accent account

1. If Turkish is a pitch accent language, there must be both accented and accentless words in the lexicon (e.g., Kamali 2011). Then, the so-called accentless words should behave like accentless words from a typological viewpoint.

2. Since accentless words presumably have no word-level stress, language users should treat such words as such in speech perception and processing. Likewise, if word-final stress is epiphenomenal due to some sort of perceptual illusion, we should not see any relevance of it for the phonological system and its penumbra.

3. If pitch-accent and stress-accent co-exist in the same grammar, their distinction must stem from factors other than the concomitants of lexical marking vs. phonological default.

5. Empirical and typological issues with the pitch accent account [4]

Accentless words Indonesian

- Indonesian has penultimate stress (except if it has a schwa, then final), but these are descriptions by non-native linguists who probably imposed their L1 stress preferences. The same has been claimed for some Hungarian scholars' descriptions of Turkish stress as having initial stress (see Lees, 1961: 71-75).
- **Halim (1974)**: No word stress ('word-accent', in his terminology) but sentence-based accent. The exact position of the accents depends on the position of the relevant words in the sentence: before an internal sentence boundary, the accent falls on the final syllable of the word preceding the boundary, whereas sentence-final accents fall on the penultimate syllable of the last word of the sentence.

- **van Zanten & van Heuven, 1998:** In word recognition gating experiments, Indonesian listeners fare no better when presented with a stressed syllable than when presented with an unstressed syllable. No consistent syllable that is judged by Indonesian listeners to sound more felicitous when associated with prominence--except for those with Toba Batak background, which has contrastive stress—(van Zanten et al., 2003).

- "In our view, the rule that drives prominence patterns in the influential Javanese variety of Indonesian is phrasal. Possibly the only phonological rule that is relevant

[4] Pitch-accent is not a coherent category; not possible to come up with an explicit definition (Hyman 2009, 2012). Recent work suggests that even in languages that allegedly have no word stress, there is metrical structure (Ko, 2013 for Seoul Korean; Duanmu, 2004 for Beijing Mandarin).

for accent location in Indonesian states that it must occur somewhere at the right edge of a phrase" (van Zanten et al., 2003: 172).

Korean

- Stress in Korean (Seoul) is controversial. Word-level stress is believed to be insignificant by most. Those who argue for it do not even agree where it surfaces.
- **Jun (1995):** Korean stress is not a word-level but a phrase-level stress. The location of the stressed syllable depends on its position in an accentual phrase, like in Indonasian. Stress falls on either the first or the second syllable of the phrase depending on the number of syllables in the phrase, syllable weight, and the position of the phrase in the sentence.

➢ True cases of accentlessness at the word level: **Unstable, variable, modulated by position (and other things).** Characteristically, Turkish stress is not like that.

6. Psycholinguistic and neurolinguistic aspects of Turkish stress

6.1. Stress deafness

- Recent experimental research has shown that differences in the way stress is employed in the listeners' L1 may determine their ability to *store* stress information in the target language (see Altmann, 2006; Peperkamp and Dupoux, 2002 for non-native stress perception typologies).
- French speakers, who have no lexically contrastive stress in their L1, cannot reliably encode contrastive stress and therefore fail on tasks that rely on long-term memory representations of stress while they can distinguish stress on the basis of acoustic information. "Stress deafness" is therefore argued to stem from processing stress at an abstract phonological level, instead of at the psychoacoustic level (e.g., Dupoux, et al., 1997; Dupoux, et al., 2001; Dupoux, et al., 2008; Peperkamp & Dupoux, 2002; Peperkamp et al., 2010).
- Turkish speakers were also reported to have problems with identifying stressed syllables of English pseudowords (Altmann, 2006).[5]

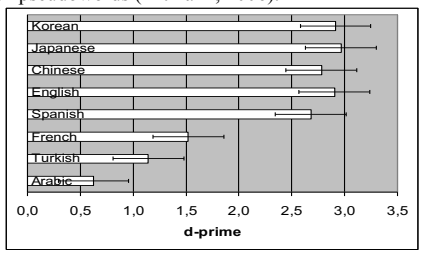


Figure 6: Discriminability scores (d-prime) for English stress identification (Altmann 2006)

✓ At first sight, these findings corroborate Kamali's assumption. However, Turkish results do not pattern with Japanese (pitch-accent) and Korean (no contrastive pitch at

[5] Highly proficient L2 English speakers heard licit English nonce words with different stress locations produced by an American English speaker and were asked to click on the stressed syllable in pseudo-transcriptions with syllable boundaries clearly marked on the computer screen (e.g., *nee.soo, shoo.bel.la, nid.doo.va.loy*, etc.).

the word level--Jun, 1998), but with Arabic and French. Altmann (2006) considers the clustering to mirror *fixed word stress* (penultimate in Arabic, final in French and Turkish) vs. *no stress* (Japanese, Korean, Chinese), or lexical stress (English, Spanish). Classifying Turkish as a pitch-accent language or as a language that has accentless words cannot explain this crosslinguistic patterning.

6.2. Neurolinguistic correlates of final vs. non-final stress

- **Domahs, Genç, Knust, Wiese & Kabak (2012):** Do Turkish speakers distinguish between violations of the default stress and violations of the non-default stress patterns?
- Deviations from lexically specified accents should yield a lexical violation effect since stress in these words is processed via the lexicon.
- Deviations from regular stress, however, should yield stress violation effects observed in other languages. But, if there is **no word-final stress**, speakers should not regard deviations from accentless words as stress violations.
- Studies using ERPs found a late positive component **(P300b)**, which surfaces whenever metrical violations lead to changes of foot structure (Knaus, et al., 2007; Domahs et al., 2008; Knaus & Domahs, 2009).

Detecting stress violations:

- **2 word types:** penultimate stress, final stress

3 stress patterns:	antepenultimate,	penultimate,	final
Penult:	*fiyasko*	***fiyásko***	*fiyaskó*
Final:	*báklava*	*bakláva*	***baklavá***

Behavioral data:

Ona söyle FIYASKO desin "Tell him/her say FIASCO"

- **Accuracy rates during EEG session:**
  - Turkish participants had some difficulties in judging incorrect conditions accurately, indicating problems to perceive deviant stress patterns.

Table 1: Accuracy rates in detecting stress violations
For example: *baklavá* *tiyátro*

	Canonical final stress	*Canonical penultimate stress*
Antepenultimate stress	72 (8)	82 (7.1)
Penultimate stress	77 (6.9)	100 (7.2)
Final stress	96 (7.3)	52 (7)

- ✓ Turkish participants had difficulties to process that *final* stress can be a violation (→ regularization?),
- ✓ Words with canonical final stress when produced with incorrect stress were however accurately detected. This behavior could not be captured if such words were accentless.

ERP data:

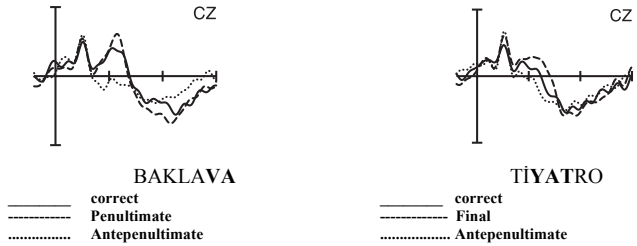


Figure 5: Grand averages of event-related potentials (ERPs) obtained for words with canonical final stress (LEFT, e.g., *bakla**va***) and canonical penultimate stress (RIGHT, e.g., *ti**ya**tro*). The correct condition (solid line) is plotted against the incorrect conditions (adopted from Domahs et al., 2012).

- Deviations from final stress (i.e., violations with antepenultimate and penultimate stress, e.g., ****bak****lava*, **bak**la**va*) evoked a significant **positivity**. Deviations from non-final stress with final stress (e.g., **tiyat**ro***), however, evoked a **negativity** effect between 500 and 750 ms, but no positivity effect at all.
- Violations with final stress produce higher costs in the *lexical* processing of such words. The N400-type effect reflects that participants notice a **lexical deviation**, suggesting that **non-final** stress is lexical *a la* Kabak and Vogel (2001). This is particularly remarkable because the words were also presented orthographically.
- In German, a stress language, a finally stressed word with a deviant stress pattern, yields a P-300 type, a **metrical structure violation component**.[6]

- **Zora et al. (2016)**: Largely confirm these findings with words and pseudowords presented in a multi-deviant odd-ball paradigm in an EEG study:
  Real word: *beBEK, beBEK…**BEbek***
  Pseudoword: *deDEK, deDEK… **DEdek***
- They find differences between words and pseudowords: While eliciting a frontally maximal **mismatch negativity** (MMN) in **real words**, *f0* manipulations elicited a frontal positivity, interpreted as a P3a response, in **pseudowords**. This *f0*-related positivity in pseudowords was considered to be a P3a response, an indication of involuntary allocation of attention to salient pitch changes. In contrast, MMN shows

[6] According to Domahs et al. (2008), positivity effects are attested in cases where the stress shift resulted in a change of prosodic structure (e.g., German: *Vi (ˈta.min)F instead of (Vi.ta)F (ˈmin)F) as opposed to a shift only in stress maintaining the foot structure (e.g., *(ˈVi.ta)F (min)F instead of (Vi.ta)F (ˈmin)F). In Turkish, however, positivity effects do not find a similar interpretation: Stress violations in words with penultimate stress did not give rise to positivity effects in Turkish although they are argued to have a prespecified trochaic foot in previous accounts (e.g, Inkelas, 1999; Inkelas & Orgun, 2003, see also Özçelik 2014). Instead, a positivity effect was found for stress shifts from the final syllable to the antepenultimate and penultimate one (from predictable to unpredictable stress).

lexical access and the recognition of a lexical difference (e.g., between *Bebek* 'a place name in Istanbul" and *bebek* 'baby').

7. Functionality: Dynamic vs. inert stress, delimitative stress

7.1. English

- ✓ Stress has a phonetic effect on segmental phonology (flapping in General American English; vowel reduction in unstressed syllables)
- ✓ Morphology also dictates certain stress properties. For example, *-al* derivatives are known to come from verbs with non-initial stress (e.g., *ar**rive**-al* vs. ****en**ter-al*).
- ✓ Stress interacts with morphology (a-prefixing*)*, word-formation (expletive infixation; **enteral*) and even phrase formation (**sweet and sour*).
- ✓ Stress correlates with word-class distinctions (roughly, verbs have final, nouns have initial stress tendency: *PUSH up vs. push UP, REcord vs. reCORD*).
- ✓ *A*-prefixing in Appalachian English is sensitive to stress. *A*-prefixing is illicit with verbs carrying non-initial stress (e.g., *a-talking* vs. **a-remembering*). Even native speakers of General American English, who do not have a-prefixing in their variety, have been shown to respect this stress constraint in an acceptability task (Kabak & Meemann 2013).
- ✓ The influence of stress (and its penumbra) on word segmentation has been widely demonstrated (e.g., Cutler and Norris 1988, see Cutler for a review).
- ✓ Harris and Perfetti (2016): Misspellings are more likely to be detected in a stressed syllable than in an unstressed syllable if the misspelled word was highly predictable from context.

7.2. Turkish

- – Very limited contrastive function: Only a handful of minimal pairs (e.g., *Bebek vs. bebek*). Note that, in the absence of vowel reduction, this is also the case for English.
- – No salient effect on segmental quality, no interaction with vowel harmony or any other segmental process
- – No clear use for word class distinction except for some adjective vs. adverb pairs, where the latter receives initial stress (Erdal 1999). Verbal roots never have irregular stress but that is epiphenomenal because they are unlikely loans in Turkish (Kabak & Plank 2012).
- – No interaction with word or phrase formation.
- – No consistent pattern in the use of stress in Turkish poetry. Although Börekçi (1995), citing Mirşan (1966), suggests that many different types of verses were used in (historical varieties) of Turkish, including accentual verse, accentual-syllabic verse, as well as Arabic verse (vezni-aruz), it is not clear whether the fixed number of stresses per line is due to fixed morphosyntactic structures that get repeated every other line.
- – More research is necessary here. In a recent project, we are investigating alignment between stressed syllables and musical prominence in Turkish *makam* music (Kabak & Domene Moreno, in prog.).

- ✓ Delimitative function: Kabak et al. (2010); Ommen (2016) (see below)

- Stress is dynamic in English, whereas it is inert in Turkish.

- Even Russian, a truly word-stress and even a truly lexical-stress language at that, displays no influence of metrical structure on morphophonology: No weight sensitivity; no clearly agreed foot structure; vowel reduction patterns are not

straightforwardly accounted for by a particular type of foot structure; no foot-based reduplication, etc. (Lavitskaya & Kabak, 2014; Lavitskaya, 2015).

➢ Absence of constraints and processes that refer to stress or metrical structure should then not be an argument against stress-accent at the level of the word.

7.3. Delimitative function of Turkish stress

- Sound and rhythmic alternations that typically characterize phonological wordhood in individual languages provide pervasive cues for word segmentation (e.g., Cutler and Norris, 1988; Peña et al., 2002).
- Edge-demarcation function of stress in a given language should then signal the language user the existence of word onsets or offsets relative to the position of the stressed syllable in the speech string (e.g., Vroomen et al., 1998 for Finnish).

Figure 7: Edge-demarcation by stress signals word boundaries

- **Kabak, Maniwa & Kazanina (2010):** 5-syllable CVCVCVCVCV auditory sequence with a trisyllabic non-word pre-target string and a non-word disyllabic target (Figure 8) placed in different positions in the sequence. Items were synthesized based on the voice of a German male speaker using a diphone-based speech synthesizer.

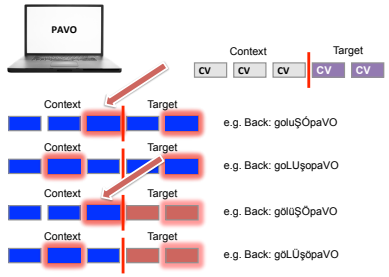


Figure 8: Stress and harmony manipulations in Kabak et al. (2010)

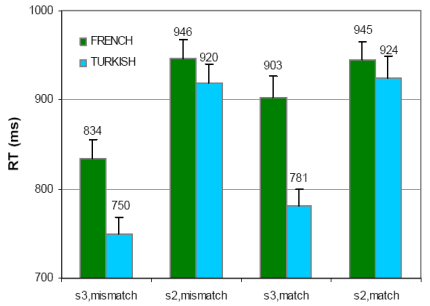


Figure 9: Mean response times for French and Turkish speakers (Kabak et al. 2010)

- Stress information in French and Turkish can facilitate speech segmentation by cueing word boundaries despite the fact that it does not promote (arguably, it even demotes) word onsets.
- Final stress has a demarcative function in Turkish and serves as a reliable cue. If the majority of words were accentless, showing no *f0* rise in the nuclear position, edge-demarcation function would not be so salient.

- **van Ommen (2016)** extended the task in Kabak et al. (2010) to other languages, namely Hungarian (fixed, peripheral, left), Polish (fixed, penultimate, right), Dutch (variable, penultimate, right) and Turkish (variable, peripheral, right), replicated the Turkish results and showed that the use of stress in segmentation is language-specific and not due to universal effects (Fig. 10, left).
- She additionally shows a facilitative effect for Turkish speakers when the **target** word conformed the native final stress pattern, i.e., they responded faster to targets with the final-stress pattern as opposed to those with initial stress (Fig. 10, right).

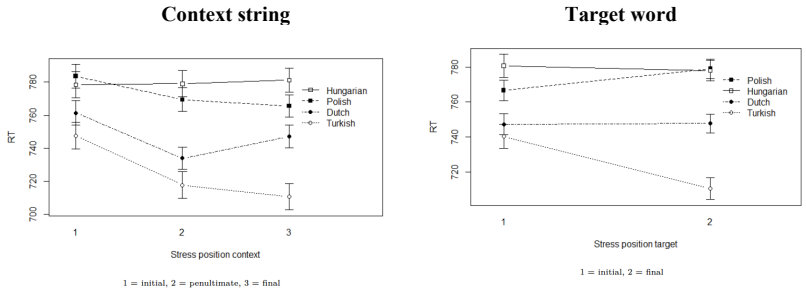


Figure 10: Effect of stress pattern on context (Left) and on target per language (from van Ommen, 2016: 59-60)

8. Emergent final stress: Processing, language acquisition and diachrony

8.1. Evidence from optimal prosodic units in segmentation

- **van Ommen (2016):** also investigated how continuous speech is parsed by listeners to see whether the segmentations show any particular stress pattern that is comparable to those patterns in their native lexicon. She used five-syllabic strings of open syllables (phonotactically legal, vowel-harmony conformed), where 2 stressed syllables were distributed in different positions (e.g., SSwww, wwwSS, wwSwS, etc.). The Turkish and Dutch participants were told that they will hear sentences in an unknown language, and were asked to type out the words they hear in each sentence (e.g., *félisiféfi*---fe lisi fefi →[S] [ww] [Sw]).

- There is a wealth of interesting patterns in van Ommen's data, which index different competing forces that guide segmentation: (i) Turkish speakers preferred to type out longer words than Dutch listeners and showed a dispreference against monosyllables (ii) The most likely position for boundaries was after the second or third syllable in both languages (iii) In both languages, when the sequence had a stress clash, the most agreed segmentation was to divide the word at the site of the clash (e.g.,wwSSw).

✓ **Optimal** prosodic structure of Turkish words is the one where stress is **rightmost** (See Table 2)

Dutch segmentation

SwwwS	Sw|ww|S	41	5.15	7.95
	Sw|wwS	75	29.66	2.53
	Sw|w|w|S	19	14.97	1.27
	Sw|w|wS	78	86.14	0.91
	Sww|wS	26	75.06	0.35
wSwwS	w|Sw|wS	16	9.71	1.65
	wSw|w|S	19	12.05	1.58
	wSw|wS	109	69.36	1.57
	wS|wwS	34	27.41	1.24
	wS|w|wS	46	97.61	0.58
wwSwS	ww|Sw|S	23	4.60	5.00
	wwSw|S	16	4.01	3.99
	wwS|wS	106	67.03	1.58
	wwS|w|S	18	11.65	1.55
	ww|S|wS	46	76.94	0.60

w = unstressed, S = stressed

Turkish segmentation

SwwwS	Sw|wwS	156	46.73	**3.34**
	Sww|wS	52	85.58	0.61
	SwwwS	24	65.10	0.37
wSwwS	wS|wwS	139	47.74	**2.91**
	wSw|wS	95	87.43	**1.09**
	wS|w|wS	16	62.77	0.25
wwSwS	wwS|wS	206	86.51	**2.38**
	ww|SwS	36	47.24	0.76

w = unstressed, S = stressed

Table 2: Dutch and Turkish segmentation preferences by frequency/expected frequency on three most divergent experimental conditions (adapted from van Ommen, 2016: 107, 113)

- Van Ommen (2016) in a corpus study also shows that it is difficult to infer a word stress system and the relation of word stress to the boundary from continuous speech by just relying on the knowledge of prominence patterns and phrase boundaries. So, mere knowledge of syllables, prominence pattern and phrase boundaries is not sufficient to learn the stress system of a language. She suggests that more information, such as first words, is necessary.
- Here, I suggest that understanding the properties of *WORD* is essential. Mobility of stress to the right-edge is the cue. But, this mobility is intertwined with the morphological complexity of words in Turkish.
- In languages like Turkish and Korean, word-level segmental phenomena are highly syllable-based (see Kabak 2014). Essentially, **the lack** of rule application (of such processes) **across words** (such as vowel harmony) suggest that they must strive to achieve phonological unity within a domain that we can call a *Phonological Word.*

➢ Stress and harmony are an indispensible components of words and signals wordhood. Vowel harmony is the **binder**, stress is the **ender**.

bo**ya**, boya**sa**, boyasa**na**, boya**dı**, boyadı**nız**, boya**mış**, boyamış**lar**, boya**sak**, boya**lar**, boya**sız**, boya**lı**, boya**mak**, boyamak**la**, boyaya**cak**, boyayacak**tı**, boyayacaktı**nız**

- Agglutinative morphology, which results in the vacillation of word size, must be a strong cue for the canonical right-edge orientation of stress.
- In fact, this prosodic cue has been assumed to be reason behind precocious acquisition of inflectional morphology in Turkish.
- Aksu-Koç & Slobin (1985) show that Turkish 2 year-olds exhibit an exaggerated tendency of putting stress on each morpheme to mark morpheme boundaries, sometimes with pauses between morphemes, especially in long strings.
- Operating Principles (Slobin 1973): Precocious acquisition due to acoustic cues that draw attention to the ends. Turkish and other sequential agglutinative morphologies may be acquired early because their morphemes are prosodically like words--i.e., syllabic and stressed (Newport & Meier 1985).

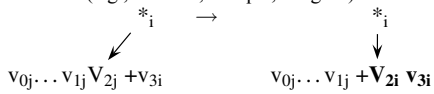
➢ Word-like morphemes, which had final stress, were indeed the impetus behind the emergence of non-final stress. Diachronically, in order for stress to be lexicalized, it has to be stuck inside the word (through prosodic adjoinment).

8.2. Evidence from the genesis of lexically-specified accents in edgemost systems

- Kabak & Revithiadou (2009b): The genesis of lexically pre-specified accents in edge-most accent systems derive from edge-most accents. ***Conflicting*** **directionality** in stress assignment at both the **word** and the **compound** level and morphologization is responsible for their emergence, which can proliferate through the subsequent application of fusion and morphological reanalysis.

- For example, in Turkish, Basque, and Moghol, accented suffixes (i.e., those that bear local accents) are always **polysyllabic** (Hualde & Bilbao 1993: 66–67), and they originate from the fusion of two reanalyzed grammatical morpheme complexes. Hence, they are never monosyllabic.

  a. Development of local accents in Rightmost systems with Leftmost compound stress (e.g., Turkish, Basque, Moghol)



- For example, in Turkish, aspectual/temporal markers such as *-Íyor*, *-Íver*, *-ÉrEk* (Banguoğlu, 1986; Korkmaz, 2003; Johanson, 1998b: 113- 114), and the negative potentiality marker *-(y)ÉmE* (Korkmaz, 2003: 815) are analyzable into **compositional structures.**

✓ Accentlessness cannot explain the evolution of morphemes that come with an accent prespecification in Turkish.

✓ Turkish non-final stress is also a result of the same accentual system that is responsible for final stress in the morphosyntax-phonology mapping.

8.3.Evidence from the "monosyllable-first" pattern

- Turkish has a large number of co-compounds. If these constructions contain a monosyllabic word, it is always the first one in the sequence.

(10)

a.	*táş toprak*	stone-soil	
b.	*sáğ salim*	alive-intact	'safe and sound'
c.	*sés seda*	sound-voice	'voice'

- Prefixal emphatic reduplication

(11)

a.	*káp-kara*	'pitch black'
b.	*más-mavi*	'very blue'
c.	*bém-beyaz*	'pure white'

- Why monosyllabic words come first can be explained by an avoidance of stress clash at the word level:

[σ́ - σσ́] *** [σσ́ - σ́]**

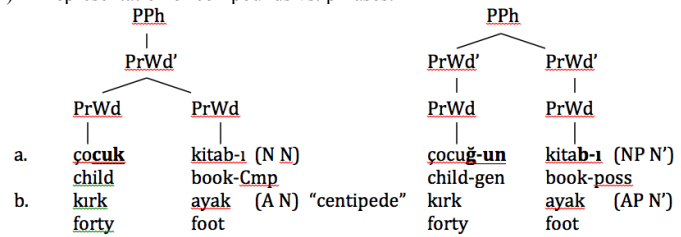
➢ Word level accentual properties determine the linear ordering of words, not sentence-level.

8.4. Evidence from compounds and phrase-medial words

8.4.1. Compound stress

- In compounds and compound-like constructions[7], leftmost constituent is promoted (hence its stressed syllable). Analogous to lexically accented stems and suffixes, the left-most accent wins in Turkish. When the leftmost constituent is a "regular" word, the primary stress of the compound is on the *last* syllable of the first word.

(12) Representation of compounds vs. phrases:



[7] Turkish compounds are argued to form a recursive PrWd (Kabak & Revithiadou, 2009a), where in most cases leftmost member wins. There are also compounds with rightmost stress (e.g., *bilgi+sayar* {information+count-Aor} 'computer')

- The degree of perceived stress in the second member yields the difference between the compound and the phrase. While the primary word stress is still perceived on the second word in phrases, it is substantially reduced, if not eliminated, on the second word in the compounds (Kabak & Vogel, 2001, see also Underhill, 1976).

- In fact, Levi's (2002b) measurements corroborate Kabak & Vogel's 2001 account in (10) for *all* speakers as far as compounds are concerned (Figure 11).

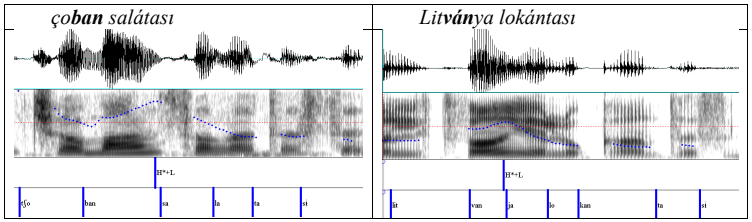


Figure 11: Left: a regular (*çoban*)+lexically accented word (*salátası*), Right: lexically accented (*Litványa*)+lexically accented word (*lokántası*) taken from Levi 2002b: 13-14).

✓ The accent on the first member of the compound originates from the level of the word, where compound stress has been computed.[8] It cannot be due to an epiphenomenon of a right edge tone assigned at the syntax-phonology mapping.[9]

8.4.2. Phonetics of phrase-final vs. phrase-medial finally stressed words (Ipek & Jun 2014):

(13) a.

[*Yoldaki*	***tuzák***	*işaretler*]$_{ip}$	*önümüzü*	*kapatıyor.*
On.the.road	trap	signs	our.front	blocking

"Trap signs on the road are blocking our view."

b.

[*Yoldaki*	***tuzák***]$_{ip}$	*işareti*	*tamamıyla*	*kapatıyor.*
On.the.road	trap	sign	completely	blocking

"The trap on the road is blocking the sign completely."

- **İpek & Jun (2014):** Stressed syllables bear a H* tone irrespective of its location (final or non-final). When a finally-stressed word appears as the last word in an Intermediate Phrase (ip), which is above the Prosodic Word, that tone bears a dual function: (i) word-level prominence, and (ii) boundary tone (H*-).
  - The magnitude of *f0* rise is found to be larger at the end of *ip* than phrase-medially.
  - The duration of the final syllable is longer at the end of *ip* than phrase-medially.
  - V-to-V co-articulation is weaker when an *ip* boundary intervenes.

[8] Even when one assumes that compounds form Phonological Phrases, final stress on the leftmost word of the phrase cannot be explained if words are accentless.

- They further show that the ip-final syllable is still marked by a H tone when the syllable is not stressed (as would be the case in a word with non-final stress, e.g., *lokánta*). These results suggest that word-final stress and boundary tone are distinct.

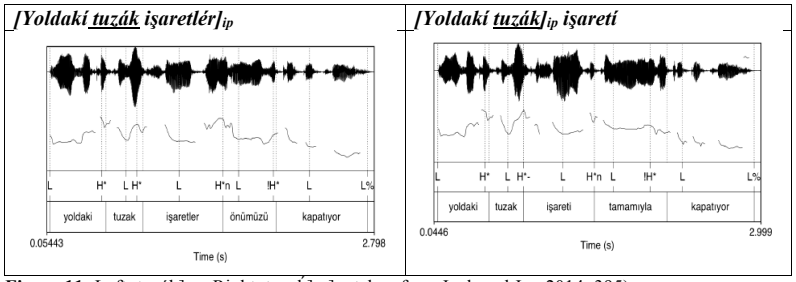


Figure 11: Left: tuzák]$_{pw}$, Right: tuzaḱ]$_{pw}$]$_{ip}$ taken from Ipek and Jun 2014: 395).

Conclusions

- Stress in Turkish, lexical or regular, has a psycholinguistic reality. Finally stressed words do not behave like accentless words and there is no unequivocal evidence that the language has a pitch-accent system.
- Turkish represents a canonical stress language, with primary function to mark off word boundaries and to signal wordhood. Deviations from this canon due to morphophonological weakening and subsequent grammaticalization have caused lexical marking of stress (Hyman 2012, see also Kabak and Revithiadou, 2009b).
- Emergent metrical patterns in speech segmentation, word order in co-compounding and compound stress speak in favor of the existence of word-level stress in non-lexically accented words in Turkish. Lexically accented morphemes that give way to non-final stress also result from once word-final stressed that gets fused into the word due to grammaticalization.
- Turkish has a different and arguably a very poor inventory of utterance level pitch events, like French (Turco et al., 2012; Braun, Galts & Kabak, 2014) and Japanese (Asano & Braun, 2012).
- Indeed, there is growing experimental evidence indicating that Turkish does not employ prosodic correlates of information structural units in the way that languages such as English and German (so-called "intonation" languages) do. For instance, syntactically isolated parentheticals are prosodically realized identically to syntactically integrated constituents such as subjects and objects (Güneş 2003, 2016). Furthermore, nuclei of IPs in different information structural conditions (narrow focus, all new focus, double foci) bear identical *f0* properties, a flat contour (e.g., İpek 2011).
- Relatively low functional load of stress contrasts at the word-level and their low density, as well as the poverty of utterance-level pitch events in Turkish may explain low sensitivity to stress (as observed in the form of stress-deafness).
- Word-level and utterance-level accentual phenomena co-exist. The mapping between these different components is systematic, but it does not privilege any one over the other.
- "Intonation does not exist in a vacuum, rather it has a specific place in the overall design of grammar, one that makes it quite different from the tones and metrical structure which are present at the output of the lexical phonology and with which it may co-occur" (Hyman, 2012: 350).

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