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4pSCb49. Towards a model of intonational phonology of Turkish: Neutral intonation

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This study proposes an Autosegmental-Metrical model of Turkish intonation based on sentences produced in neutral focus, as part of our ongoing research investigating Turkish intonational phonology. Tonal patterns of utterances were examined by varying the length of a word and a phrase, the location of stress, syntactic structures, and sentence types. Preliminary results suggest that Turkish has a H* pitch accent, realized on the stressed syllable of most content words. Each content word forms one Prosodic Word (PW) whose left edge is marked by an L tone. There are two prosodic units higher than PW: an Intermediate Phrase (ip) marked by a final rising (LH) tone and an Intonational Phrase (IP) marked by various types of a final boundary tone. These three prosodic units are also distinguished by the degree of juncture. Interestingly, the ip-final LH boundary tone marks the right edge of a heavy syntactic constituent regardless of the length of the unit. Furthermore, the left edge of a nuclear pitch accent is also marked by a rising tone (LH) which is realized on the last syllable of the immediately preceding PW. The ip-final LH tone and the pre-nuclear LH tone are phonetically different and perceptually distinct.

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1. INTRODUCTION

This paper presents the intonation of declarative sentences in Turkish produced in neutral focus, analyzed within the framework of Autosegmental-Metrical (AM) model of intonational phonology (e.g. Pierrehumbert 1980, Beckman and Pierrehumbert 1986, Ladd 1996/2008). This is part of our ongoing research investigating a full model of Turkish intonational phonology. There are a few studies on Turkish intonation (e.g., Levi 2002, Özge 2003, Kan 2009, Kamalı 2011) analyzed in the AM framework. However, these studies are either partial descriptions of Turkish intonation, thus lacking generalizations, or include tonal categories that are phonetic in nature.

Turkish is defined here as standard Turkish based on the dialect of Istanbul. The word order in Turkish is flexible but a canonical word order is subject-object-verb. In neutral contexts, the immediately pre-verbal word is usually the most prominent word, i.e., receiving a nuclear accent, in the entire sentence.

Traditionally, Turkish has been categorized as a stress-accent language (e.g. Lees 1961, Lewis 1967, Sezer 1983) with majority of the words being lexically stressed on their final syllables. For this group of words, a root final stress shifts to a word final syllable if suffixes are added. Words that do not follow this stress pattern are classified into two groups. One type is when words bear exceptional root stress. These words are confined to certain place names and borrowed words. Stress on such words falls on the antepenultimate syllable if the ante-penult is heavy and the penult is light, and falls on the penultimate syllable otherwise (Sezer 1983). Another type of non-final stress arises when certain affixes, such as the negative morpheme *-mA*, are attached to a word. These affixes do not carry stress themselves but block stress from moving rightwards.

While the word level prosody in Turkish has been studied extensively, the phrasal level prosody, that is, a prosodic structure above the word level and the intonational realizations, is less well studied. Kan (2009) is the first study, to our knowledge, to suggest a prosodic structure of Turkish and their tonal properties above the word level. However, the tonal categories proposed in Kan's model are not distinctive, as expected from a phonological model. Pitch accents such as H^* , $!H^*$, $L+H^*$, and $L+!H^*$ and phrase boundary tones such as $L+H-$ or $L+!H-$ are linguistically not meaningful, nor have distinctive function. Kamalı (2011) provides a unified account of different pitch accents and edge tones suggested by Kan (2009) and builds a phonological model of Turkish intonation. This model is built upon two main assumptions: (i) following Levi (2005), the author considers Turkish as a lexical pitch-accent language, and (ii) finally stressed words are suggested to be not lexically stressed. In this model, the words with a non-final stress are claimed to have a lexical pitch accent, H^*+L , as in Tokyo Japanese (Beckman & Pierrehumbert 1986, Pierrehumbert & Beckman 1988) and the words with a final stress are claimed to have no lexical specification. The high tone realized on the word-final syllable, i.e., traditionally stressed, is analyzed as a High boundary tone ($H-$) of a phrase (either Accentual Phrase, a Phonological Phrase, or a Major Phrase). Therefore, this model predicts that the prosodic phrasing of an utterance is not determined by the syntactic and semantic grouping of words, but by the type of word, especially the location of "stress" in the traditional analysis. That is, Kamalı's model predicts that a prosodic boundary, marked by $H-$, exists at the end of a word not because the word is the last word of a prosodic phrase, but because the word, having a word final stress, has a High tone on its final syllable (see Section 3).

In the paper, we will show that a stressed syllable is realized as a high pitch accent, H^* , regardless of the location of stress (Section 2.1), and a boundary tone, $LH-$, is realized at the end of an Intermediate Phrase (ip), which mostly corresponds to the right edge of a syntactic constituent such as a Noun Phrase (NP) or a Postpositional Phrase (PP). That is, the prosodic group marked by $LH-$ is not sensitive to the type of phrase-final word but to the syntactic structure (Section 2.3). We will also show that a high tone realized on the word-final syllable, immediately preceding the nuclear word, is different from the $LH-$ ip boundary tone. Instead, it marks the left edge of a nuclear word (Section 2.2). That is, we claim that there are two types of boundary tones in Turkish realized at the end of a word within an Intonation Phrase. One marks the right edge of an Intermediate phrase (labeled as " $LH-$ " or " H^*- ") and the other marks the left edge of a nuclear word (labeled as " LHn " or " H^*n ").

In order to observe various tonal patterns and decide the underlying tonal categories, we varied the length of a word and a phrase, the location of stress, and the syntactic structure of a phrase. The data for this study are collected from 3 Turkish speakers, 2 females (BK, TY) and one male (HD), in their 20s and 30s. Participants repeated each sentence three times as an answer to a question eliciting neutral focus. Recordings were done, using Praat (Boersma 2001), in a quiet room using a head-mounted microphone

connected to a laptop computer. Pitch tracks were analyzed using Praat. In the following section, we present our model by describing the f₀ pattern in the representative pitch tracks of simple declarative sentences produced in a neutral-focus context.

2. INTONATIONAL CONTOUR of DECLARATIVES

2.1 Pitch Accent

As shown in Figure 1 and Figure 2, a typical intonation contour of a declarative sentence in Turkish consists of a sequence of rising tones [L H*], showing f₀ downtrends over the phrase, followed by a L boundary tone (L%) at the end. The L tone of each rising tone marks the left edge of every prosodic word and a H* pitch accent is associated with the stressed syllable of a prosodic word. Figure 1 and Figure 2 show pitch tracks of 5-word and 4-word sentences, respectively, where each prosodic word except for the verb has a final stress. To indicate the location of stress, a stressed syllable is written in a capital letter on the words tier (2nd tier) and the acoustic interval of each stressed syllable is marked as 'S' on the bottom tier of each pitch track. The other tiers are for tones (1st tier) and English glosses (3rd). The same format is used for all pitch track figures in the paper.

Both figures show that every stressed syllable is realized with a High pitch accent except for the verb. The f₀ peak of the nuclear word (the word immediately preceding the verb) is much lower than that of the preceding word. This substantial lowering of f₀ peak of nuclear pitch accent (NPA) relative to the preceding peak, thus showing almost the same f₀ value as the preceding L tone, seems to be the property of the NPA. In order to mark this distinction, we label the NPA with !H*. But as can be seen in Figure 3, lowering the f₀ peak for the NPA is not observed when the NPA is phrase initial.

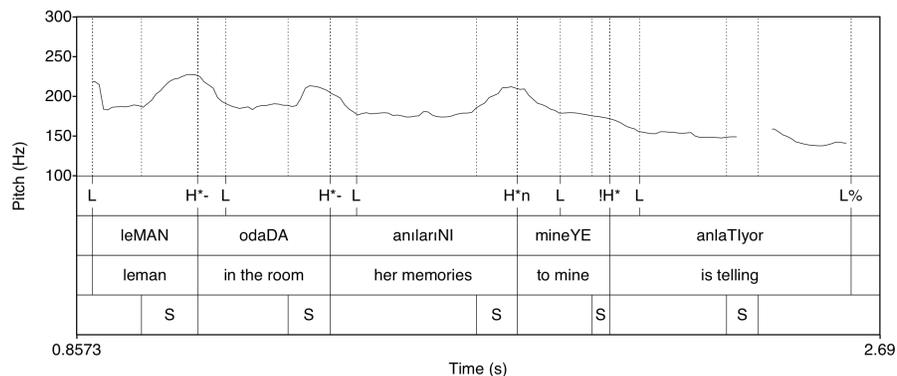


FIGURE 1. Sample pitch track of 5 word sentence *Leman is telling her memories to Mine in the room*. Every word except for the Verb has a final stress. (The interval of stressed syllable is marked by 'S' on the bottom tier.)

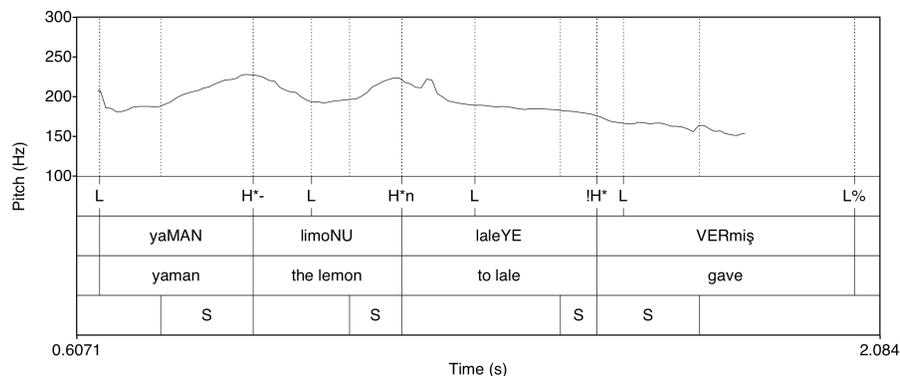


FIGURE 2. Sample pitch track of 4 word sentence *Yaman gave the lemons to Lale*. Every word except for the verb has a final stress.

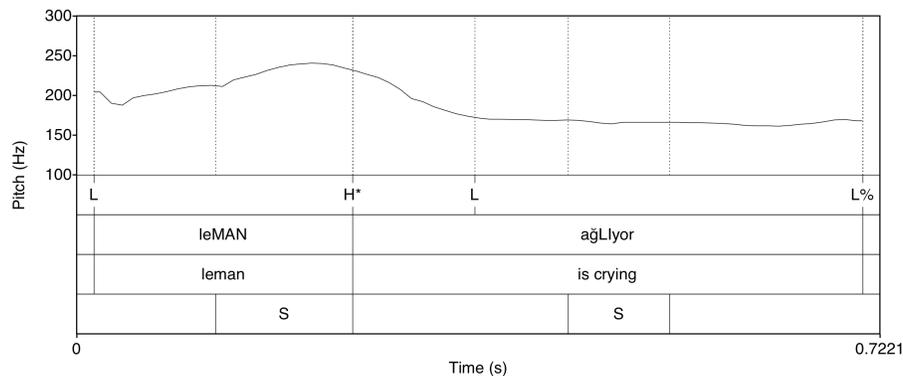


FIGURE 3. Sample pitch track of two word sentence *Leman is crying*.

Figure 4 shows a pitch track of a 5 word sentence where the first two words have a non-final stress. As in the case of Figures 1-3, the stressed syllable of every word except for the verb is realized with a f0 peak (H*). The f0 peak at the end of the first two words is a boundary tone (LH-) marking the end of an Intermediate Phrase. See Section 2.3 for a detailed description of LH-.

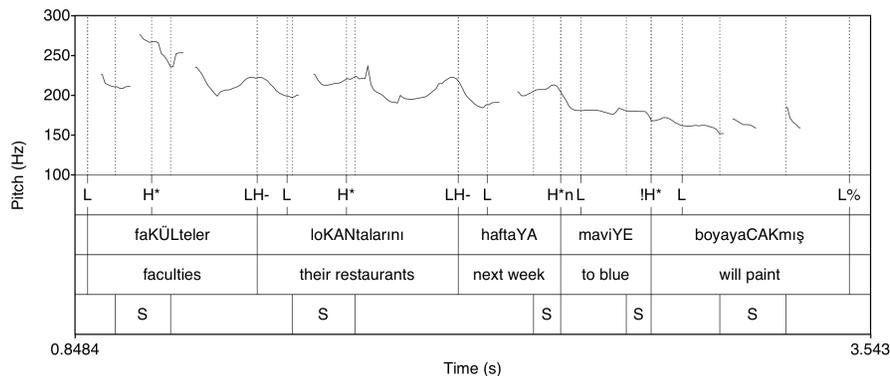


FIGURE 4. Sample pitch track of 5 word sentence *Faculties will paint their restaurants to blue next week*. The first two words have a non-final stress.

2.2 A Boundary Tone Marking the Left Edge of Nuclear Accent, LHn

An interesting feature of Turkish intonation is the tonal properties of nuclear word and nuclear pitch accent. As we have seen in the sample pitch tracks above, the tonal event on a sentence-medial nuclear word itself does not seem to be salient, being realized as a mid level f0 (!H*). Interestingly, what makes the nuclear word salient is the boundary tone realized just before the nuclear word, that is, the high f0 on the final syllable of the word immediately preceding the nuclear word. This is illustrated in Figures 5, where a rising tone (LHn) marks the beginning of a nuclear word by being realized on the last syllable of the immediately preceding prosodic word, *tamamıyla*. This pre-nuclear word has a penultimate stress, realized as a H* pitch accent. Thus, the rising tone at the end of the word must be a phrasal tone related to the following nuclear word. This is evident when the same word is not immediately preceding the nuclear word (*to her nephew*) as in Figure 6. Here, the word, *tamamıyla*, shows only one tonal event, i.e., the H* pitch accent on the penultimate stressed syllable. Therefore, we can conclude that the second tonal rise at the end of the word, *tamamıyla*, is not a property of the word, but is a boundary tone marking the left edge of the following nuclear word. This boundary tone marking the beginning of the nuclear word is labeled as “LHn”. We believe the left edge of a nuclear word is always marked by a rising tone in Turkish (cf. Ipek 2011), but when the pre-nuclear word has a word-final stress, thus having a H* pitch accent on its final syllable, as in the word, *the works*, in Figure 6, the H* pitch accent also functions as a boundary tone marking the following nuclear word. We will label this double functioning High tone as “H*n”.

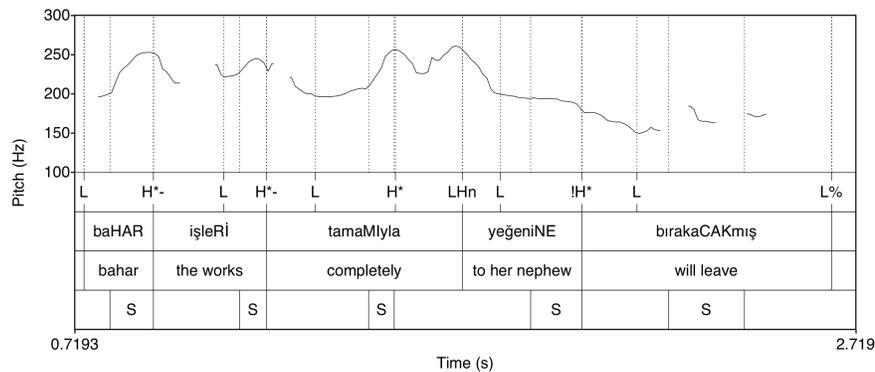


FIGURE 5. Example pitch track of *Bahar will leave the works completely to her nephew*. The adverb *tamamıyla* ‘completely’ immediately precedes the nuclear word ‘to her nephew’, and shows double f_0 peaks. The first one is a H^* pitch accent and the second one is a boundary tone marking the following nuclear word.

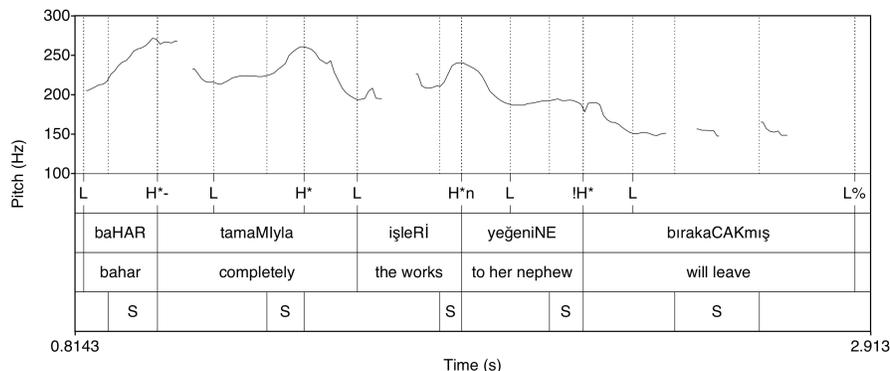


FIGURE 6. Example pitch track of *Bahar will leave the works completely to her nephew*. When the adverb *tamamıyla* ‘completely’ is not immediately preceding the nuclear word ‘to her nephew’, the adverb shows only one f_0 peak, a High tone (H^*) on its stressed syllable. The boundary tone marking the left edge of a nuclear word is now realized at the end of *işleri*, a pre-nuclear word. Since this syllable is also stressed, we label it as H^*n .

2.3 A Boundary Tone Marking the Right Edge of an Intermediate Phrase, LH-

So far we have shown that when a sentence is produced as one Intonational Phrase (IP), it consists of a sequence of rise tones, and that each rising tone roughly marks the domain of prosodic word (PW). However, our preliminary observations suggest that there is a prosodic unit between a PW and an IP. This unit, called an Intermediate Phrase (ip), often corresponds to a syntactic constituent. Interestingly, certain syntactic phrases such as a noun phrase (NP) or a post-positional phrase (PP) form one ip and its right edge is systematically marked by a rising tone (LH-) regardless of the number of words contained in the syntactic constituent. In the following three figures (Figures 7-9), we demonstrate the tonal properties of an NP by modifying the number of words in it. The NP appears as the subject of the sentence in all of the examples. All the nouns within the subject NP are chosen to have non-final stress so that we could tease apart the status of high f_0 at the end of an NP. That is, we could show that not every noun shows high f_0 at its final syllable and that the high f_0 at the end of NP is not a pitch accent associated with the stress syllable of the NP-final word but a boundary tone marking the end of NP. In order to rule out the possibility that the high f_0 at the end of an NP is the LHn tone marking the following nuclear word (see Section 2.2), the word *cumaya* (“on Friday”) is inserted in between the subject NP and the nuclear word (marked by !H*).

In Figures 7-9, the subject NP includes two, three, and four nouns, respectively. The stressed syllable of each noun shows a H^* pitch accent and only the NP-final noun shows another f_0 peak (LH-) on its final syllable. When an NP has only one word as in Figure 4, the NP-final syllable is realized with the rising tone, LH-, in addition to the H^* on the stressed syllable. Note that the first two words in Figure 4 are NPs: the first one is a Subject NP and the second one is an Object NP, and each NP-final syllable is marked by

LH-. However, when the NP-final word has a final stress, the high tone on the syllable would have a double function (marking a pitch accent and a boundary), so we label it as “H*-”. This is similar to the case of H*n, where the pre-nuclear boundary tone and a pitch accent are hosted by the same syllable.

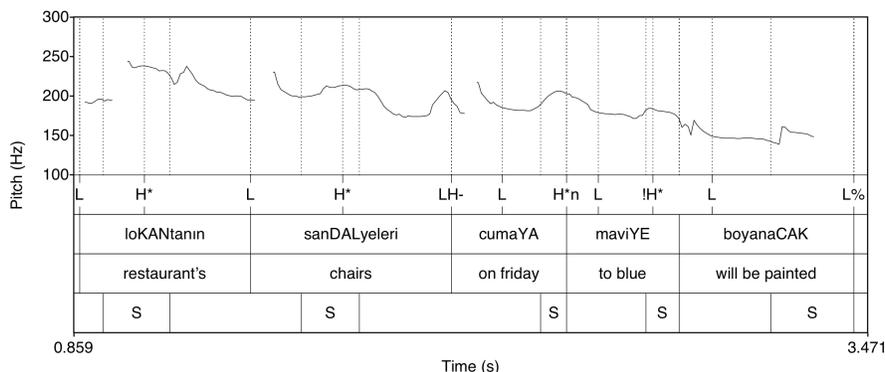


FIGURE 7. Sample pitch track of a declarative sentence *Restaurant's chairs will be painted to blue on Friday*. The subject NP ('Restaurant's chairs') contains two words with non-final stress. The end of the 2nd word, which is the last word of the subject NP, is marked by a rising tone, LH-.

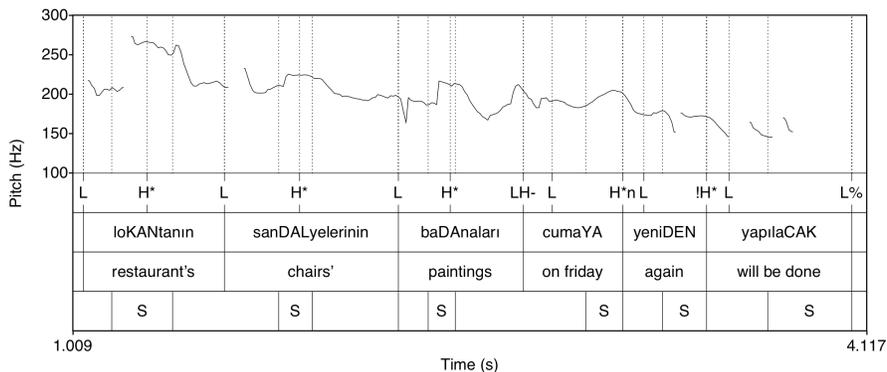


FIGURE 8. Sample pitch track of a declarative sentence *Paintings of the restaurant's chairs will be done again on Friday*. The subject NP contains three words. As in Figure 7, all words in the subject NP have non-final stress (realized as H*), and the last syllable of the NP is marked by a rising tone, LH-.

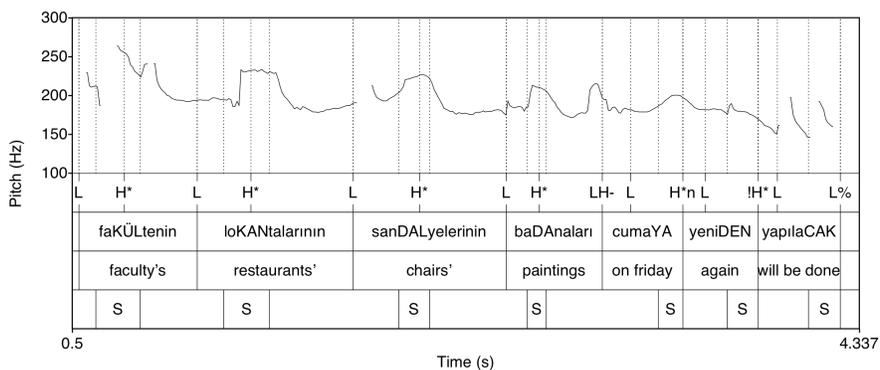


FIGURE 9. Sample pitch track of a declarative sentence *Paintings of the faculty's restaurants' chairs will be done again on Friday*. The subject NP contains four words with non-final stress. Here, again, the NP-final syllable is marked by a rising tone, LH-.

On the other hand, not every syntactic constituent forms a prosodic phrase. For example, an adjective phrase does not constitute its own prosodic grouping. The pitch tracks in Figure 10 and Figure 11 demonstrate this lack of prosodic marking at the end of an adjective phrase. In the figures, the adjective phrase appears inside a subject NP. All the words in the subject NP are non-finally stressed. In Figure 10,

both the adjective ‘bembeyaz’ and the noun ‘sandalyeler’ in the subject NP are marked by a pitch accent H* on their non-final stressed syllable, and together form one prosodic phrase marked by an LH- boundary tone realized at the right edge of the head noun. The subject NP in Figure 11 contains an adverb + adjective + noun sequence. Each word within this NP receives a pitch accent H*, but here too, only the right edge of the head noun is marked with an additional rising tone (LH-), grouping the whole NP as one prosodic phrase, but not the right edge of the adjective phrase.

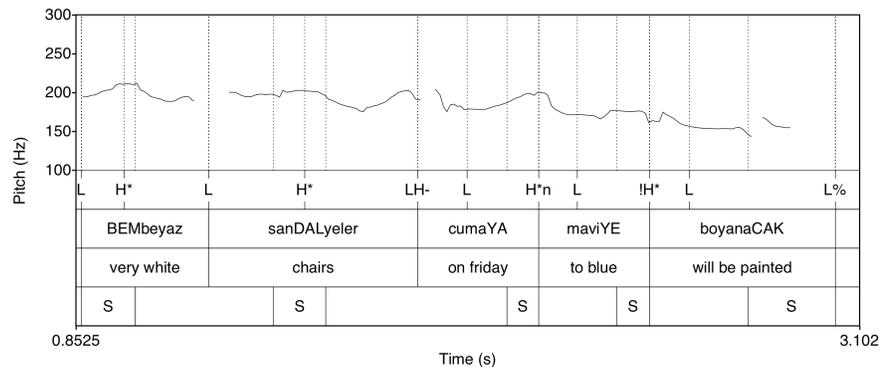


FIGURE 10. Sample pitch track of a declarative sentence *Very white chairs will be painted to blue on Friday*. The LH-boundary tone marks the end of the subject NP ‘bembeyaz sandalyeler’, which corresponds to an ip.

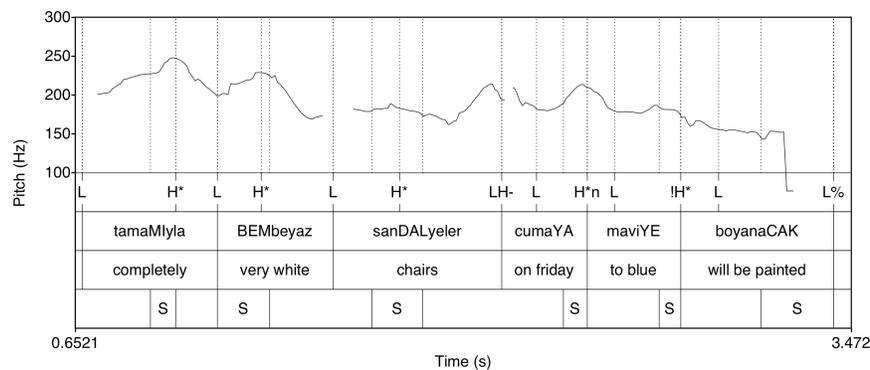


FIGURE 11. Sample pitch track of a declarative sentence *Completely white chairs will be painted to blue on Friday*. The subject NP includes an adjective phrase, *tamamiyla bembeyaz* ‘completely white’ before a head noun, but the adjective phrase-final syllable is not marked by any tone. LH- tone marks only the end of the subject NP, forming an ip.

We have shown that in Turkish there are two types of LH boundary tones inside an Intonational Phrase. One is the LH boundary tone marking the left edge of a nuclear word (LHn or H*n) and the other is the LH boundary tone marking the right edge of an argument phrase (LH- or H*-). Now the question is: do these two boundary tones belong to the same prosodic unit? Our informal observation of acoustic data and the pilot perception data suggest that they do not. The NP-final or PP-final syllables marked by LH- are slightly lengthened and the degree of juncture after NP-final words is bigger than that of the NP-medial words. This was found true even when the NP has only one word, though there were some variations when an NP was really short. Since an NP or a PP can include several words, we propose that the phrase marked by LH- is an Intermediate Phrase (ip), not an Accentual Phrase (AP) which is slightly larger than a word, typically including one word and one pitch accent (Jun 2005, to appear). On the other hand, the degree of juncture marked by the LHn tone seems to be similar to a phrase-medial word boundary, thus weaker than that marked by the ip-final LH- tone. Interestingly, when the LHn boundary overlaps with the LH-boundary (e.g., when the final syllable of the pre-nuclear word is also the final syllable of an NP), LHn seems to override LH-. That is, the host syllable is not lengthened and listeners perceive this juncture similar to the phrase-medial prosodic word boundary, thus weaker than an ip boundary.

3. DISCUSSION and CONCLUSION

In this paper, we have reported our preliminary data and analysis on Turkish intonation and prosodic structure in the AM framework of intonational phonology. In particular, we have focused on simple declarative sentences in a neutral focus context in canonical word order. We propose that Turkish has three prosodic units: a Prosodic Word (PW), an Intermediate Phrase (ip), and an Intonational Phrase (IP). All of these units are marked by an edge tone. A PW is marked on its left edge, and an ip and an IP are marked on their right edges. A H* tone is associated with the stressed syllable of most prosodic words. This is true regardless of the location of stress. This is one of the major points where our analysis differs from Kamalı's (2011) intonational model in which finally stressed words do not have a pitch accent but are marked by a phrase tone (H-) of Accentual Phrase (AP)/Phonological Phrase (PhP)/Major Phrase (MaP). This is a consequence of the author's claim that so-called finally stressed words in Turkish are in fact not lexically stressed. As mentioned earlier, one of the major problems that this kind of an analysis encounters is that prosodic phrasing is solely determined by the lexical property of the component words. For example, a two-word genitive NP or an "adjective-noun" NP can form one phrase or two phrases depending on whether the first word has stress on the final syllable or not. If the stress is non-final in the first word as in (1a), the two words together would form one AP/PhP/MaP, but if the stress is final in the first word as in (1b), the first word would form one AP/PhP/MaP and the second word would form a second AP/PhP/MaP. However, in our pilot data on the degree of juncture at each word boundary, listeners report that the juncture after the NP-internal word is weaker than that of the NP-final word, suggesting that the NP as a whole forms one prosodic phrase regardless of the lexical property of the component words.

(1) Kamalı's analysis

- a. loKANtanın sanDALyeleri 'Restaurant's chairs'
 [L H*+L H*+L H-] => one AP/PhP/MaP
 BEMbeyaz sanDALyeleri 'Very white chairs'
 [L H*+L H*+L H-] => one AP/PhP/MaP
- b. otelİN + sanDALyeleri 'hotel's chairs'
 [L H-][L H*+L H-] => two APs/PhPs/MaPs
 beYAZ + sanDALyeleri 'white chairs'
 [L H-][L H*+L H-] => two APs/PhPs/MaPs

Another interesting property of Turkish intonation is the effect of nuclear word on the tonal properties of its immediate vicinity. The pitch accent on the nuclear accented word is produced with a relatively compressed pitch range, which we label as !H*. In addition, a nuclear word is systematically marked on its left edge by a rising boundary tone (LHn or H*n), which is realized on the final syllable of the immediately preceding word. This phenomenon, though rare, is similar to the AP final boundary tone in Tokyo Japanese (Beckman & Pierrehumbert 1986, Pierrehumbert & Beckman 1988) where the AP-final L boundary tone is realized on the initial syllable of the following AP.

In sum, in Turkish, an IP can have one or more ips and an ip can have one or more PWs. A PW is tonally marked by the word-initial L boundary tone and a H* pitch accent realized on the stressed syllable. An ip is tonally defined by a rising tone at the end of ip (i.e., LH- and H*-). An IP is defined by a final boundary tone (L% for declaratives) and its final syllable is substantially lengthened. The ip-final syllable is slightly longer than a PW-final syllable but the degree of phrase-final lengthening is much weaker than that of the IP-final syllable. The domain of ip shows a strong correspondence to a syntactic constituency. In particular, certain syntactic phrases such as a noun phrase and a postpositional phrase are systematically marked at their right edges, forming one ip. Interestingly, the right edge of these syntactic phrases is marked by an ip boundary tone regardless of the number of words in the phrase, and is perceived as having a bigger juncture than that of a PW. Though the ips presented in this paper always correspond to a syntactic constituent, it seems possible that an ip is also formed by non-syntactic factors such as the length of a phrase or speech rate. More study is needed to investigate these factors. Finally, a nuclear word is realized with a reduced pitch range (!H*) but its left edge is marked by a prominent boundary tone (LHn or H*n). More study is needed to investigate the acoustic realizations of the tonal inventory, especially the two types of LH boundary tones. Furthermore, intonation patterns of various syntactic structures and different sentence types as well as focus prosody should be examined.

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