Bulgarian Tones and Break Indices (Bg_Tobi): A System for Intonational Annotation

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Abstract. The paper outlines a system of Tones and Break Indices for Bulgarian (BG_ToBI) within the autosegmental-metrical framework of intonational phonology. While taking into account previous research on Bulgarian intonation, the system draws on more recent empirical research, and thus attempts to reflect the latest prosodic developments in the language. It is based on analyses of corpora specially collected for the purpose which include read as well as semi-spontaneous speech.

We propose a system for transcription of Bulgarian intonation which comprises an inventory of two prosodic units (the intonation phrase and the intermediate phrase), five pitch accents (L*, L*+H, L+H*, H*, H+!H*), two phrase accents (L- and H-) and three boundary tones (L%, H% and %H), and describe the default pre-nuclear and nuclear pitch accents and boundary tones for several communicative types of utterance. In order to account for the variable alignment of the default prenuclear pitch accent in Bulgarian, we propose another unit in the prosodic hierarchy which provides an anchorage domain for it - the prosodic word. Our analyses show that there are various strategies for signaling the information structure of an utterance by implementing different combinations of word order variation and intonational category choices.

This research contributes to the study of Bulgarian intonation within the autosegmental-metrical model of intonational phonology, and of intonation grammar in general. However, more systematic research is needed on both the phonetics and phonology of intonation and the interplay of intonation, syntax and information structure in Bulgarian.

Keywords: Bulgarian intonation, autosegmental-metrical phonology, pitch accents, phrase accents, boundary tones

Бистра Андреева. Снежина Димитрова. ИНТОНАЦИОННИ АКЦЕНТИ И ИНДЕКСИ ЗА ГРАНИЦА В БЪЛГАРСКИ ЕЗИК (BG_TOBI): СИСТЕМА ЗА АНОТАЦИЯ НА ИНТОНАЦИЯТА

Резюме. Статията представя система от интонационни акценти и индекси за граница за български език BG_ToBI, разработена в рамките на автосегментно-метричния модел за интонационна фонология. Вземайки предвид резултатите както от традиционни, така и от по-нови емпирични изследвания върху българска интонация, системата отразява най-новите тенденции в нейната употреба в съвременния език. Анализирани са специално събрани за целта корпуси, които включват четена и полуспонтанна реч.

Предложената система за анотация на българска интонация включва две прозодични единици (интонационна фраза и междинна фраза), пет интонационни акцента (L*, L*+H, L+H*, H*, H+!H*), два фразови акцента (L- и H-) и три гранични тона (L%, H% и %H). Описани са и основните предядрени и ядрени интонационни акценти и гранични тонове, които се използват в някои комуникативни типове изказване. За описанието на вариативността при синхронизиране на високия таргет (H) от най-често срещания предядрен акцент (L*+H) спрямо границите на метрично силната сричка предлагаме включването на допълнителна единица в прозодичната йерархия за български език, а именно прозодичната дума. Беше установено също така, че съществуват различни стратегии за сигнализиране на информационната структура, като за целта се използват различни комбинации от словоред и интонационни акценти.

Като използва автосегментно-метричния модел на интонационната фонология, това изследване допринася за по-пълното описание на българската интонация и интонационната граматика. Необходими са обаче по-систематични изследвания както на фонетиката, така и на фонологията на интонацията, а също така и на взаимодействието ѝ със синтаксиса и информационната структура на българския език.

Ключови думи: българска интонация, автосегментно-метрична фонология, интонационни акценти, фразови акценти, гранични тонове

Research /Научно изследване

1. Introduction

The aim of this paper is to outline a ToBI system for Bulgarian (BG_ToBI), based on the autosegmental-metrical framework of intonational phonology and following the conventions described in Pierrehumbert (1980), Beckman and Pierrehumbert (1986), Beckman et al. (2005), Ladd (1996, 2008), among others. Such an outline will (i) enable scholars studying Bulgarian intonation who come from diverse theoretical backgrounds to share results and research outcomes, (ii) make it possible for systematic cross-language comparisons to be conducted, especially with other Slavonic languages for which ToBI systems have been developed, (iii) equip teachers and researchers working in applied linguistics with a useful tool for carrying out contrastive analyses of Bulgarian and other languages with a view to

facilitating the acquisition of foreign language intonation, or of the intonation of Bulgarian as L2.

While largely taking into account previous research on the intonation of Bulgarian, the system outlined in this paper is predominantly based on more recent empirical research, and thus attempts to reflect the latest prosodic characteristics and developments which have taken place in the language in the last couple of decades. Such recent research has been based on corpora specially collected for the purpose which include read as well as semi-spontaneous speech.

The paper is organized as follows. Section 2 presents an overview of previous work on Bulgarian intonation: 2.1 discusses configuration-based descriptions, and 2.2 presents early levels-based approaches. Section 3 outlines the most recent research in the field inspired by the autosegmental-metrical approach of intonational phonology and presents the inventory of pitch accents, phrase accents and boundary tones in Bulgarian. Finally, section 4 summarizes the inventory of nuclear configurations and traces directions for future research.

2. Previous work on Bulgarian intonation

2.1 Configuration-based accounts

Among the first scholars who discuss Bulgarian intonation is Stoykov (1942, 1966) who adopts a syntactically based approach to the description of the main melodic contours of declaratives, imperatives and interrogatives. Using instrumental and auditory analysis, Stoykov shows that the contour of simple declarative utterances is a gradually falling one, and that of non-final clauses in a complex or compound declarative sentence is a rising one signaling incompleteness. Questions formed with a question word or the interrogative particle „li“ have the same contour as simple declaratives, while those without a question word or particle have a rising intonation contour. Imperatives are distinguished from declaratives on the basis of their wider pitch range and more abrupt changes of pitch direction (Stoykov 1966: 157).

Several later studies carried out in the 1960's and 1970's follow the same descriptive approach based on sentence types and syntactic categories, and rely heavily on auditory analysis, often supported by acoustic measurements (Popov 1963; Georgieva 1967, 1970; Georgieva 1974; Mahrova 1978). In her typological account of the intonation of Slavonic languages, Nikolaeva (1977) measures the fundamental frequency, intensity and duration of accented and unaccented syllables, and on the basis of the experimental results describes the melody of different sentence types.

Tilkov also views intonation as a complex linguistic phenomenon which involves fundamental frequency features (melody, range and register), intensity char-

acteristics (word stress, 'logical stress' and 'phrasal stress') and temporal characteristics (pauses and tempo) (Tilkov 1981: 23). He uses the term 'logical stress' for the emphatic realization of the nuclear syllables in narrowly focused words, and 'phrasal stress' – for non-emphatic nuclear accent. Although Tilkov describes the general direction of the pitch movement in the pre-nuclear part of the utterance, he doesn't explicitly mention pre-nuclear accent(s) and/or their type(s).

Following the tradition of syntactically based investigation of intonation, Misheva (1991) uses short utterances comprising one to five syllables, and varies the position of stress in order to study the role of the intonation contour in signaling the communicative type of utterance: statement vs. command vs. question. Misheva analyses both their global and local prosodic characteristics. She finds the same global rising-falling contour in all three utterance types. However, she reports statistically significant differences in local characteristics such as the alignment of the F0 maxima with the accented syllable: in statements the peak is reached early in the accented syllable or in the pretonic one, whereas in questions it is reached late in the accented syllable or in the posttonic one. Misheva also manipulates the word order (SVO and OVS) in short declarative sentences to investigate what she terms the 'focusing' function of intonation and interprets the results using the concepts of theme and rheme. Like Tilkov (1981), she describes the general direction of the F0 movement in the thematic part of the utterance with respect to the focused syllable, and concludes that it is the absence of accentual prominence which is the linguistically relevant feature of themes (Misheva 1991: 137). In the rheme, on the other hand, she notes that there is always accentual highlighting. Misheva and Nikov (1998) observe that rhemes are phonetically characterized by the same accentual pattern independent of the focus type - neutral (in broad focus), contrastive, emphatic (in narrow focus), the only difference being the tonal contrast between the accented and the unaccented syllables of the rheme as well as differences in phrasing. This has been disproved by later autosegmental-metrical analyses of Bulgarian intonation.

Misheva and Nikov (1998) distinguish semantic accents (corresponding to pitch accents) and phrase accents (corresponding to boundary tones). The main unit of phrasing in their system is the syntagm (corresponding to the intonation phrase) defined in semantic and syntactic terms as consisting of one or more prosodic words organized by intonation and delimited by two types of pauses: objective (silent) pauses and subjective pauses, caused by an interruption of the continuity of the prosodic features of the speech signal.

A major problem of these configuration-based approaches is that they do not attempt to establish an inventory of intonation units typical of the language. Also, such a phonetic approach leads to rather general conclusions, most of which only confirm already well-known generalizations.

2.2 Early level-based accounts

Penchev (1980) dedicates much of his work to information structure and the role of intonation in indicating theme – rheme relations in Bulgarian sentences, starting from the assumption that both intonation and word order are very important for signaling information structure in the language. His investigation of Bulgarian intonation follows the American structuralist tradition (Pike 1945; Trager and Smith 1951). Penchev posits five pitch levels (level 1 is the lowest and level 5 – the highest) and describes the main intonation contours in Bulgarian in terms of the movement of the pitch from one level to another in several parts of the phrase, namely, the beginning, the pre-central part, the center, and the post-central part. Penchev describes six neutral (depending on the focus position) and four emphatic (regardless of the focus position) intonation contours. Contours 1 and 2 are both falling, but while in contour 1 the pre-central part is lower than the centre, contour 2 typically has a high beginning and the pitch gradually falls to the bottom of the speaker's range. Contour 3 begins at a mid level and rises gradually. Contours 4 and 6 are similar to contours 1 and 2, respectively. The difference is that contour 4 and 6 both have final rises. Contour 5, like contour 3, begins at a mid level but instead of gradual rise it ends with a fall-rise. Contours 4, 5, and 6 typically signal non-finality and occur in utterances which are divided into two or more intonation phrases.

The emphatic contours are modifications of the neutral ones and signal contrast or speaker attitude. Penchev views contrast as the negation of the information provided in the previous context. It can be signaled by strengthening, either through an increase of F0 on the accented syllable, or through a decrease of F0 (deaccentuation or, in Penchev's terminology, 'de-rhematisation') on the preceding content word, both of which result in a greater pitch difference between the focused and given parts of the utterance.

A disadvantage of Penchev's approach is the fact that his classification criteria are so interrelated that given the appropriate linguistic context, one can ultimately assign several meanings to almost any contour without knowing which elements contributed to their interaction.

3. Autosegmental-metrical accounts

The autosegmental-metrical approach (Pierrehumbert 1980, Beckman & Pierrehumbert 1986) uses two tones: (H(igh) tones and L(ow) tones, which are realized as peaks and valleys, respectively. These tones are linked to particular points in an utterance and have no absolute pitch values: at the phonological level, each pitch accent is described relative to the one preceding it in the intonation phrase. There are monotonal pitch accents (e.g., H* or L*) and bitonal accents (e.g., L*+H,

H+L*). The tone with the star is associated with the accented syllable, i.e. it is realized as a peak or a valley on the accented syllable. Unstarred tones in a pitch accent are temporally separate from a starred tone and are normally associated with the pretonic syllable if they are leading tones, and with a posttonic syllable if they are trailing tones. A distinction is made between boundary tones terminating intermediate phrases (L- and H-) and those at the end of intonation phrases (L% and H%). An intonation phrase comprises at least one intermediate phrase and thus always has a combination of a phrase accent and a boundary tone (e.g., L-L%, L-H%). They determine the intonational pattern from the last accent (= nuclear accent) to the end of the phrase.

The autosegmental-metrical approach and ToBI transcription system have been applied to Bulgarian (Andreeva et al. 2001; Andreeva 2007, 2009; Dimitrova and Jun 2015; Andreeva et al. 2016; Dimitrova et al. 2018, among others) establishing relations between phonological tonal categories, their phonetic realization and their information-structural functions. The corpora on which the analyses are based contain both semi-spontaneous speech acquired in map tasks (Anderson et al. 1991) and strictly-controlled read speech data (sentences in different focus conditions, passages) produced by speakers of contemporary standard Bulgarian born and raised in Sofia. In line with the original ToBI for American English (Beckman et al. 2005), our model builds upon an on-ramp analysis and employs both leading and trailing tones. An inventory of five pitch accents (L*, L*+H, L+H*, H*, and H+!H*), two phrase accents (L-, H-), and one initial and two final boundary tones (%H, L%, H%) is derived from the combined analysis of the data. The inventory is defined with respect to the information structure and the various communicative sentence types which are investigated.

In the illustrations in this paper we use the following tiers:

1. tone tier on which the pitch accents and the edge tones (phrase accents and boundary tones) are transcribed using the conventional ToBI symbols and the modifiers for alignment (early/late) and scaling (upstep/downstep).
2. syllable tier with the phonetic transcription of each syllable. The division into syllables follows the conventions of Bulgarian phonetics.
3. word tier: Because the Bulgarian alphabet is based on the Cyrillic script, our examples are transliterated in italics following the Bulgarian Transliteration Law conventions (2009). The translation is given in single quotes.
4. break index tier: where phrase boundary strength information is recorded.

3.1 Pitch accents

H* is predominantly used in declarative sentences in Bulgarian and signals new information. The accented syllable is perceived as high. Phonetically, the H* is manifested as a peak on the accented syllable and is preceded by a slightly rising

onglide with no clear low target before the peak (Figure 1). The phonetic realization of this accent is variable. This variability is especially noticeable in contexts of tonal crowding as reported by Andreeva et al. (2016). In their data, when the accented syllable is early in the sentence, the H target is reached close to the end of the accented syllable in 57 % of the cases, in the middle – in 23% of the cases, and close to the beginning – in 20 % of the cases. When the focus is realized late in the sentence, the H target is reached close to the beginning of the accented syllable in 75% of the cases, in the middle – in 21% of the cases, and close to its end – in only 4 % of the cases. Results from auditory tests reported by Misheva and Nikov (1998) show that statements in which the focused word occurs early and the peak is aligned at the beginning of the syllable are perceived as more confident answers compared with statements of the same structure in which the peak is aligned later.

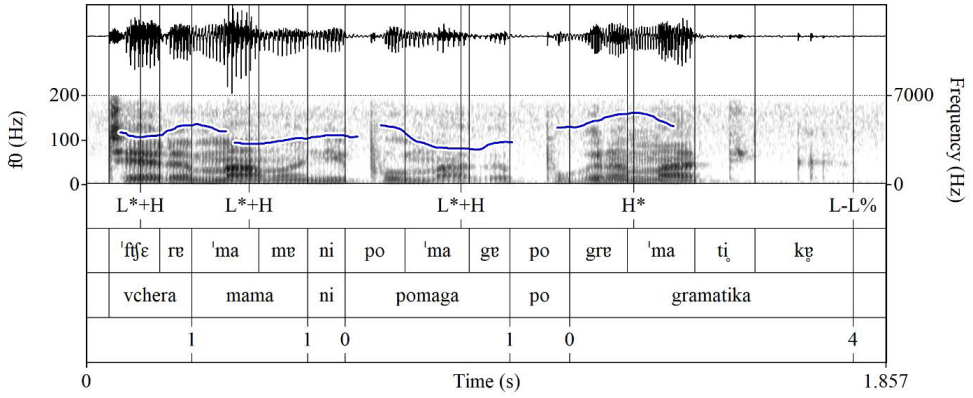


Figure 1: Waveform, spectrogram, and F0 contour of the broad-focus statement ***Вчера мама ни помага по граматика****. (‘Yesterday mum helped us in grammar.’).*

L+H* signals new information and is realized as a sharp rise (or a jump) from a low target in the preceding syllable or at the very beginning of the accented syllable up to a high target reached late in or just after the accented syllable (Figure 2).

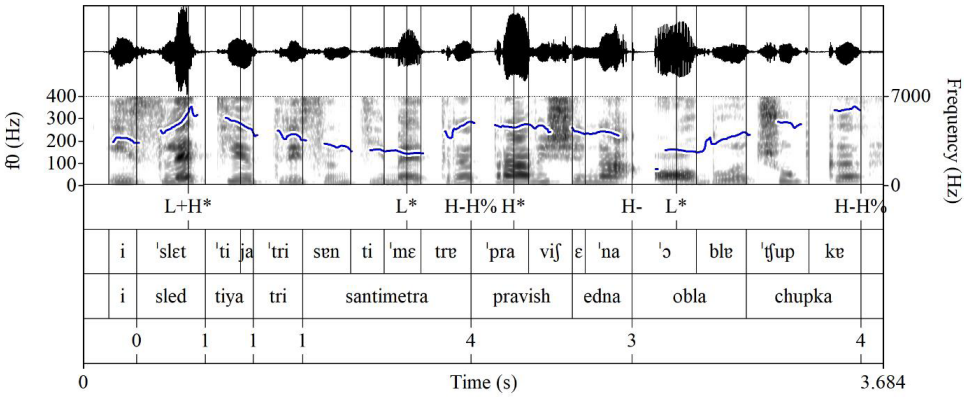


Figure 2: Waveform, spectrogram, and F0 contour of the utterance ***И след тия три сантиметра правиш една обла чупка …*** *('And after these three centimeters, you make a round turn …') from the map task corpus.*

Researchers have different views on whether H* and L+H* are categorically different pitch accents or whether they are just two extremes of one and the same accent type. Pierrehumbert (1980) and Pierrehumbert and Hirschberg (1990) claim that only L+H* can be preceded by a low target, while the statistical evidence provided by Ladd and Schepman (2003) shows that this is also true for H*. The question whether these two accents are associated with different meanings is also debatable. For Bulgarian, Andreeva and Oliver (2005) and Oliver and Andreeva (2008) have shown that the domains of interpretation of H* and L+H* overlap. Both accent types can signal either new information or a presence of contrast. Some speakers show a clear preference for L+H* pitch accents in narrow contrastive focus conditions, and for H* in narrow non-contrastive focus conditions, whereas other speakers show a strong tendency towards realising L+H* in both narrow non-contrastive and contrastive focus.

Dimitrova and Jun (2015) report a variant of the bitonal L+H*, namely LH*, where both the L and the H target are aligned with the syllable edges, and there is at least 10 Hz F0 rise within the accented syllable. However, their perception experiments demonstrate the functional similarity of L+H* and LH* in narrow non-contrastive and narrow contrastive focus, and of H* and LH* in broad as well as in narrow non-contrastive and contrastive focus. Thus Dimitrova and Jun's results confirm previous findings regarding the functional equivalence of H* and L+H*.

L* is characterized by a shallow fall and is realized as a local low pitch in the lower third of the speaker's range. This accent appears mostly in nuclear position

in some open questions with small degree or absence of speakers' confidence, and before a continuation rise (Figure 2).

In L*+H the L tone is aligned within or slightly before the accented syllable and the trailing H tone is aligned in the first post-tonic syllable or after it. In contrast to L+H*, the perceived pitch of the accented syllable in L*+H is low. This accent type is one of the frequently used pitch accents in the pre-nuclear position, but L*, H* and L+H* are also observed (Andreeva 2007; Andreeva et al. 2016; Dimitrova and Andreeva 2017; Dimitrova et al. 2018). These findings refute earlier claims by Misheva 1991, Misheva and Nikov 1998, and Penchev 1980 that the pre-nuclear part of the Bulgarian declarative utterance is unaccented. L*+H also occurs in nuclear position in yes-no questions but is usually realized with a wider pitch range (Figure 3).

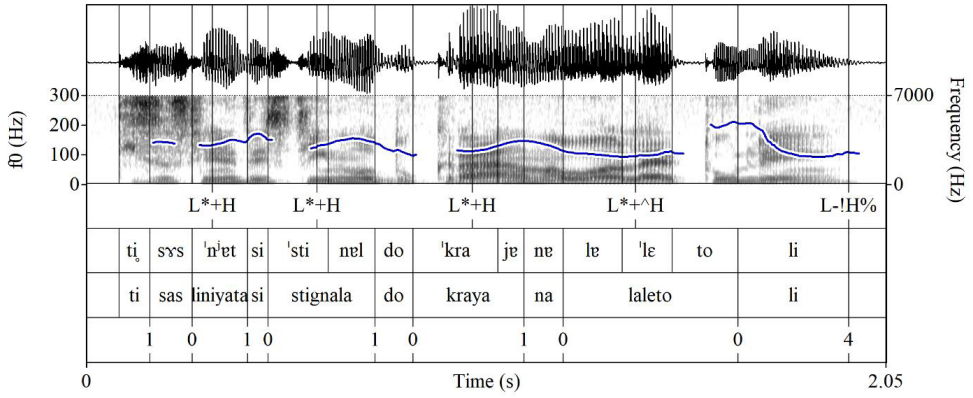


Figure 3: Waveform, spectrogram, and F0 contour of the narrow focus yes-no question ***Ти с линията си стигнала до края на лалето ли?*** *('Have you got with the line to the end of the tulip?') with objective[1] alignment (given-before-new) – map task corpus.*

Dimitrova and Jun (2015) focus on the variable alignment of the high trailing tone in the L*+H pitch accent, which in their data was sometimes realized as far

[1] Ivanchev (1957/1978) calls the linear order of rheme preceding theme 'subjective alignment', and distinguishes it from the 'objective alignment', where the thematic part of the utterance linearly precedes the rhematic one. Subjective (rheme-before-theme) alignment is considered communicatively unmarked for Bulgarian interrogative, imperative and exclamatory utterances, with the objective (theme-before-rheme) alignment pattern being the marked word order variant. In declarative utterances, on the other hand, objective alignment is considered to be communicatively unmarked, and subjective alignment is considered to be marked.

to the right as the second posttonic syllable. They suggest that the H tone may be a phrasal accent. Such variability of tonal alignment in free stress languages is not unknown (see, for example, Themistocleous 2016 on Cypriot Greek). Dimitrova and Andreeva (2017) find a tendency for the trailing tone of the L*+H pitch accent to align later with slower speaking rate for most but not all of their speakers. This shows that the H target of the bi-tonal pitch accent is not separated by a fixed distance and/or a fixed time interval from the starred tone, as postulated by Pierrehumbert's invariance hypothesis (Pierrehumbert 1980: 80). Therefore, we hypothesize an anchorage domain (Welby and Loevenbruck 2005, 2006; Themistocleous 2016) of the L*+H, namely, the prosodic word, where the L* is aligned with the onset of the lexically stressed syllable (or just before it), while the H trailing tone aligns with a following unstressed syllable within the domain of the prosodic word. However, we also found counter-examples in which the H spreads to the first or second syllable of the next prosodic word. Data in the research literature designed to test the stability of tonal alignment often involves the repetition of long sentence lists. Our data, on the other hand, come from a variety of sources, including semi-spontaneous speech. We suspect that Kohtz and Niebuhr's (2013) findings that the repetition of long sentence lists leads to training effects and more stable productions by speakers than is usual in everyday speech, may provide an explanation for the variability in our data. However, more experimental evidence is needed to confirm or reject our hypothesis. Figure 4 illustrates the variability in the alignment of the H target in three consecutive pre-nuclear L*+H pitch accents. It may be a clearly high target, which in the first pitch accent is aligned at the beginning of the second posttonic syllable, in the second pitch accent – with the vowel of the first posttonic syllable and in the third pitch accent – with the vowel onset of the third posttonic syllable. Sometimes the high target may be even hard to detect, as in the third pitch accent in Figure 1, where the it is part of the gradual rise to the next upstepped high target. It is important to note that upstep in Bulgarian is a gradual phonetic modification of the pitch which depends on the communicative intention of the speaker.

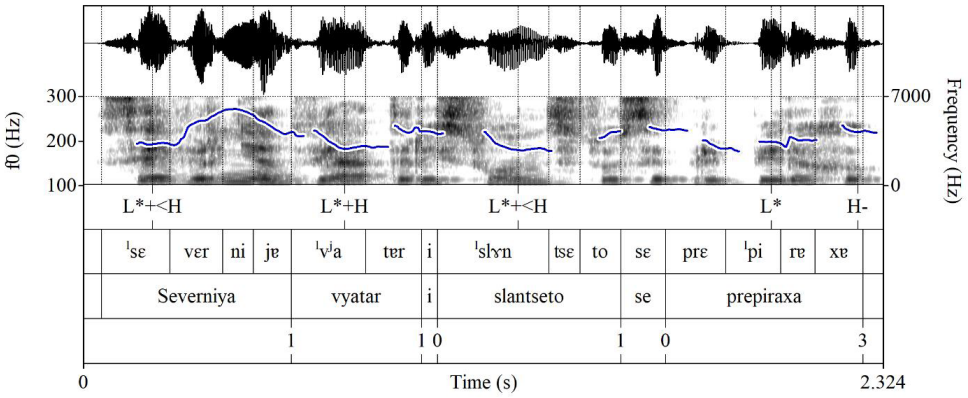


Figure 4: Waveform, spectrogram, and F0 contour of the utterance ***Северният вятър и слънцето*** *('The North Wind and the Sun').*

H+!H* is realized as a fall from a high pitch target on the pretonic syllable which continues throughout the accented syllable and usually ends in the postaccented one. The height of the pretonic syllable may be a high target or the end of a plateau (Figure 5). Some speakers may complete the fall earlier, around the offset of the accented syllable. This is the reason why in earlier autosegmental-metrical analyses this realization of the tone has been labeled as H+L* (Andreeva et al. 2016). Indeed, the accented syllable in H+L* is perceived as much lower than in H+!H* which may be due to the gradient difference in the prominence of the pitch accented syllable. The two realizational variants are predominantly used in nuclear position in broad focus. H+!H* is used to confirm a fact and is more neutral. Its variant realization as [H+L*] is more typical of concluding statements, expressing definiteness. The difference between the two is thus stylistic. However, a dedicated perception experiment is needed to confirm that speakers reliably hear the difference between the two variants. We will label these realizations of early peaks as H+!H* because this variant is the unmarked one.

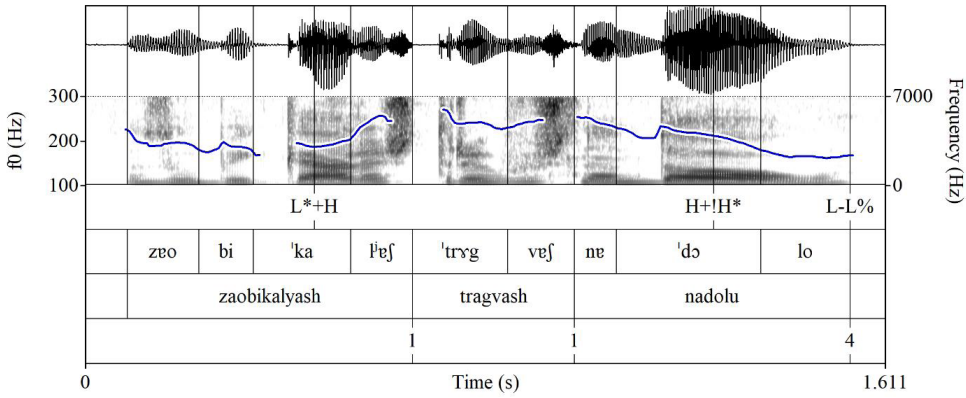


Figure 5: Waveform, spectrogram, and F0 contour of the broad focus statement ***Заобикаляш, тръгваш надолу.*** *('You go round, go down.') from the map task corpus.*

3.2 Phrase accents

There are two phrase accents associated with the right edge of the intermediate phrase:

L- is realized as a F0 minimum low in the speaker's range.

H- is realized as a F0 maximum which is roughly equal in height to the peak of the preceding H tone in the phrase. When the syllable on which the nuclear H tone is realized is followed by several unstressed syllables, there is a high plateau which spreads to the right edge of the intermediate phrase.

3.3 Boundary tones

There are also two final boundary tones – L% and H%, associated with the right edge of the intonation phrase, and one initial boundary tone - %H, associated with its left edge. A mid or low initial boundary tone is not labelled.

An example of the L-H% final low rise is given in Figure 6. It is realized on a final unstressed syllable: in the first intonation phrase, this is the final syllable of a three-syllable word обаче ('however') and is immediately preceded by the H* nuclear accent, whereas in the second intonation phrase, the low rise is preceded by as many as five unstressed syllables. For an example of the initial %H boundary tone see Figure 7.

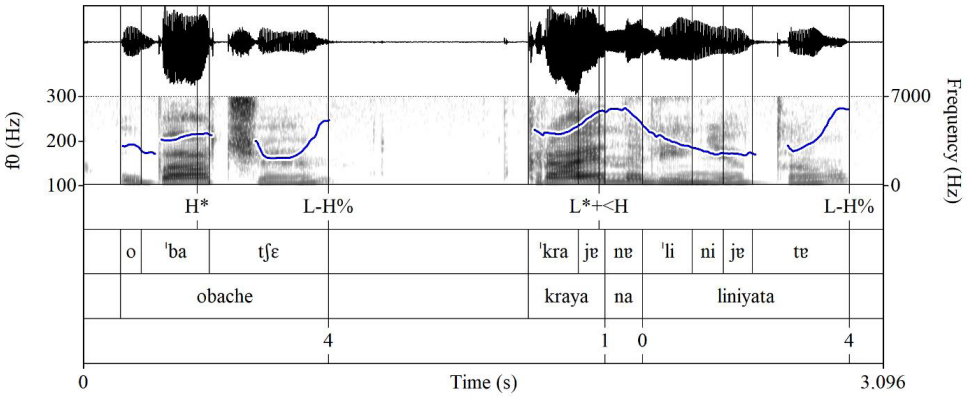


Figure 6: Waveform, spectrogram, and F0 contour of the utterance ***Обаче … в края на линията …*** *('However ... at the end of the line ...') from the map task corpus.*

The H targets of the pitch accents, phrase accents and boundary tones described above may be modified through scaling of the pitch range (downstep or upstep). In the case of downstep (!H), the top line of the pitch range is lowered, so that the H target is shifted downwards with respect to the preceding H tone (Figure 7). In the case of upstep (^H) the H target is shifted upwards. Additionally, the pitch accents can be modified through different timing (early or late) of the tonal targets. If the tonal target of a pitch accent occurs outside the syllable, the MAE_ToBI conventions (Beckman et al. 2005) are followed, and the label '>' is used when the tone occurs before the relevant syllable, or '<' when it occurs after it. The symbols for the modifiers (!, ^, <, >) are placed before the affected tone.

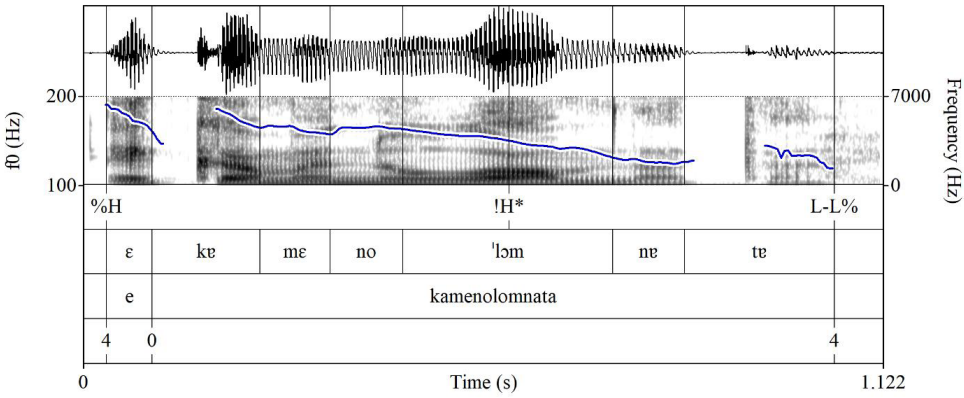
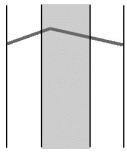
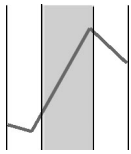


Figure 7: Waveform, spectrogram, and F0 contour of the narrow focus yes-no question with 'closed' meaning ... ***е каменоломната?*** *('.... is the quarry?') from the map task corpus.*

Table 1 and 2 provide a summary of the phonological pitch accent and edge tone categories proposed for Bulgarian.

Table 1: Inventory of pitch accent categories.

schematic representation σ ˈσ σ	**pitch accent type**	**Description**
	H*	peak on the accented syllable, preceded by a slightly rising onglide with no clear low target before the peak
	L+H*	sharp rise (or jump) from a low target in the preceding syllable or at the very beginning of the accented syllable up to a high target late in or just after the accented syllable

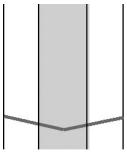
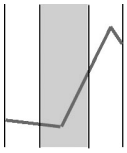
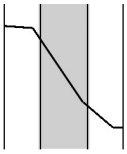
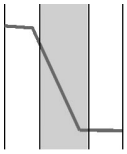
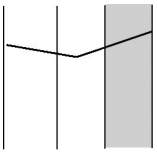
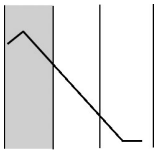
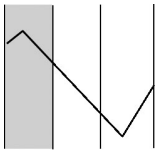
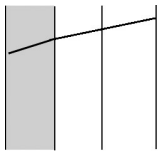
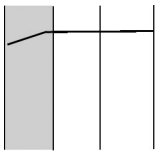
	L*	local low pitch in the lower third of the speaker's range
	L*+H	valley within or slightly before the accented syllable, the trailing H tone is aligned in the first post-tonic syllable or after it
 	H+!H*	a) fall from a high pitch target on the pretonic syllable to a downstepped target in the accented syllable b) fall from a high pitch target on the pretonic syllable to a low target in the accented syllable

Table 2: Inventory of edge tone categories, shown in the vicinity of H* (the accented syllable is shaded).

schematic representation σ σ σ	edge tones	description
	%H	phrase initial high boundary, realized on the first syllable of the intonation phrase
	L-L%	low stretch at the end of the intonation phrase

	L-H%	fall-rise ending in the upper part of the speaker's range
	H-H%	high rise at the end of the intonation phrase which reaches the upper part of the speaker's range
	H-L%	Plateau

3.4 Break indices

Following general ToBI conventions, the degree of juncture perceived between words and phrases is encoded by means of break indices. '0' is used for any juncture smaller than a lexical word boundary (i.e., for a juncture between clitics and their hosts, or between two clitics). '1' marks the juncture corresponding to a prosodic word boundary, '2' marks perceived juncture with no intonation effect, or apparent intonational boundary without a pause or any other clues, '3' marks the juncture corresponding to an intermediate phrase boundary, and '4' marks the juncture corresponding to an intonational phrase boundary.

4. Conclusions

This paper attempted to propose a system for transcription of Bulgarian intonation based on the general principles of the framework of autosegmental-metrical theory using the ToBI transcription system. The Bulgarian intonational system comprises an inventory of five pitch accents (L*, L*+H, L+H*, H*, H+!H*), two phrase accents (L- and H-) and three boundary tones (L%, H% and %H). The prosodic units are the intonation phrase and the intermediate phrase. The default prenuclear pitch accent is L*+H, and the default nuclear one is H*. The default nuclear pattern for declaratives is H*/H+!H* L-L%, and for yes/no questions L*+H L-L%. Table 3 shows the nuclear configurations and stylized tunes along with their meanings.

Table 3: Inventory of nuclear configurations and stylized tunes and their meanings.

BG_ToBI	Context/Meaning
H* L-L%	declaratives with broad, narrow non-contrastive and narrow contrastive focus, closed yes/no questions
H* L-H%	polite yes/no questions with 'closed' meaning, non-finality
H* H-H%	non-finality
^H* L-L%	emphasis
%H ^H* L-L%	lively introduction of new information
!H* L-L%	matter-of-fact statements
H+!H* L-L%	declaratives with broad and narrow non-contrastive focus, confirmation of a fact, concluding statement, definiteness
L+H* L-L%	declaratives with narrow non-contrastive and narrow contrastive focus, 'open' yes/no questions, wh-questions
L*+H L-L%	'extra-open' yes/no questions with and without Q-li
L*+H L-H%	yes/no questions with and without Q-li signalling incredulity, non-finality
L* H-H%	'extra-open' yes/no questions with and without Q-li, non-finality
(L*+H)[2] !H* L-L%	wh-questions with post-focal accent
L+H* L-	neutral vocatives
L+<H* L-L% [+long]	insistent vocatives
L* H* L-L% [+long]	challenging chant
L+H* !H* H-L% [+long]	vocative chant

Bulgarian pitch accents are often characterized by variable alignment of the tonal target with the tone-bearing unit, which constitutes a challenge for the 'classical' autosegmental-metrical theory. This variability of the phonetic realization is triggered by speaker-specific production strategies as well as by the position of the accented syllable within the phrase. For example, when the default H* pitch accent is early in the phrase, the H target is usually reached close to the end of the accented syllable. When it is late in the phrase, the H target is reached close to the

[2] The focus-associated pitch accent on the wh-word is given in brackets.

beginning of the accented syllable. The trailing tone (H) of the L*+H pitch accent can be shifted to the right when it is followed by several unaccented syllables. We hypothesize an anchorage domain, namely, the prosodic word, where the L* is aligned with the onset of the lexically stressed syllable (or just before it), while the H trailing tone aligns with a following unstressed syllable within the domain of the prosodic word. However, we also found counter-examples in which the H spreads to the first or second syllable of the next prosodic word. We need experiments with strictly controlled material in order to shed more light on the nature and size of this anchorage domain.

The combined analyses of data from read and semi-spontaneous speech corpora have enabled us to study the interaction between information structure and intonation, the importance of which is broadly recognized in the literature. Our analyses show that there are different strategies for signaling the information structure of an utterance by implementing different combinations of word order variation and intonational category choices. Our results so far have shown that, on the one hand, speakers use different pitch accent categories to signal a specific focus type, and on the other hand, they use the same pitch accent category to signal different focus types but manipulate the strength of one or more of the acoustic properties, or suppress or enhance the prominence of surrounding words.

This research contributes to the study of Bulgarian intonation within autosegmental-metrical model of intonational phonology, and of intonation grammar in general. However, more systematic research is needed on both the phonetics and phonology of intonation and the interplay of intonation, syntax and information structure in Bulgarian.

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Bibliography

Anderson, A., Bader, M., Bard, E. G., Boyle,E., Doherty, G., Garrod, S., Isard, S., Kowtko, J., McAllister, J., Miller, J., Sotillo, C., Thompson, H. and Weinert, R. (1991), The HCRC Map Task Corpus, *Language and Speech* 34(4), pp. 351–366.

Andreeva, B. (2007), *Zur Phonetik und Phonologie der Intonation der Sofioter-Varietät des Bulgarischen*, PhD dissertation, PHONUS 12, Institute of Phonetics, University of the Saarland, Saarbrücken.

Andreeva, B. (2009), Towards the intonational phonology of the Sophia Variety of Bulgarian, in G. Zybatow, U. Junghanns, D. Lenertová, and P. Biskup (Eds.), *Studies in*

Formal Slavic Phonology, Morphology, Syntax, Semantics and Information Structure. *Proc. of FDSL 7*, Peter Lang, Frankfurt/Main, pp. 357–371.

Andreeva, B. (2017), Prosodic Encoding of Phrasal Prominence and Information Structure in a Second Language: When Bulgarian and German Prosody meet, *Contrastive Linguistics* XLII, 2017/1, pp. 59–83.

Andreeva, B., Avgustinova, T. and Barry, W. J. (2001), Link-associated and focus-associated accent patterns in Bulgarian, in Zybatow, G., Junghanns, U., Mehlhorn, G. and Szucsich, L. (Eds.), *Current Issues in Formal Slavic Linguistics* (Linguistik International; 5). Peter Lang, Frankfurt/Main, 353–364.

Andreeva, B., Barry, W. J. and Koreman, J. (2016), Local and global cues in the prosodic realization of broad and narrow focus in Bulgarian, in Żygis, M. and Z. Malisz (Eds.), *Special Issue, Slavic Perspectives on Prosody*. *Phonetica* 73, pp. 260–282.

Andreeva, B. and Oliver, D. (2005), Information Structure in Polish and Bulgarian: Accent Types and Peak Alignment in Broad and Narrow Focus, in S. Franks, F. Y. Gladney and M. Tasseva-Kurktchieva (Eds.), *Formal Approaches to Slavic Linguistics 13: The South Carolina Meeting 2004*, Michigan Slavic Publications, Ann Arbor, pp. 1–12.

Beckman, M. E., Hirschberg, J. and Shattuck-Hufnagel, S. (2005), The original ToBI system and the evolution of the ToBI framework, in S.-A. Jun (Ed.), *Prosodic Typology: The Phonology of Intonation and Phrasing*. Oxford University Press, Oxford, pp. 9–54.

Beckman, M. and Pierrehumbert, J. (1986), Intonational structure in Japanese and English. *Phonology Yearbook* 3, pp. 15–70.

Bulgarian Transliteration Law (2009), *Darzhaven vestnik*19, 13.03.2009. https://www.lex.bg/bg/laws/ldoc/2135623667 [Accessed 11 January 2021]. Закон за транслитерацията (2009), *Държавен вестник* 19, 13.03.2009.

Dimitrova, S. and Andreeva, B. (2017), Prenuklearni aktsenti v balgarskia ezik, in M. Danova, S. Dimitrova and M. Kovacheva (Eds.) *Novi napravlenia v sinhronnata i diahronnata fonetika i fonologia*, St. Kliment Ohridski University Press, Sofia, pp. 152–166. Димитрова, С. и Андреева, Б. (2017). Пренуклеарни акценти в българския език, М. Данова, С. Димитрова и М. Ковачева (редактори): *Нови направления в синхронната и диахронната фонетика и фонология,* Университетско издателство „Св. Климент Охридски“, София, 152–166.

Dimitrova, S., Andreeva, B., Gabriel, Chr. and Grünke, J. (2018), Speaker age effects on prosodic patterns in Bulgarian, *Proc. Speech Prosody 2018* (Poznań, Poland), pp. 709–713.

Dimitrova, S. and Jun, S.-A. (2015), Pitch accent variability in focus production and perception in Bulgarian declaratives, *Proceedings of the 18th ICPhS*, The University of Glasgow, Glasgow, Paper 0832.1-5. Available at: https://www.internationalphoneticassociation.org/icphs-proceedings/ICPhS2015/Papers/ICPHS0832.pdf [Accessed 18 Jan. 2021]

Georgieva, M. (1967), Po vaprosa za melodikata na balgarskia ezik, *Balgarski ezik* 1, pp. 13–22. Георгиева, М. (1967), По въпроса за мелодиката на българския език, *Български език* 1, 13–22.

Georgieva, M. (1970), Melodia na prostoto izyavitelno razshireno izrechenie v balgarskata literaturna rech, *Izvestia na Instituta za balgarski ezik* 19, pp. 83–89. Георгиева, М. (1970), Мелодия на простото изявително разширено изречение в българската литературна реч, *Известия на Института за български език* 19, 83–89.

Georgieva, M. (1974), Intonatsiata na edin vid eliptichni vaprositelni izrechenia v balgarski i ruski ezik, *Sbornik v pamet na Prof. St. Stoykov. Ezikovedski izsledvania*, Sofia, pp. 77–82. Георгиева, М. (1974), Интонацията на един вид елиптични въпросителни изречения в български и руски език, *Сборник в памет на проф. Ст. Стойков. Езиковедски изследвания*., София, 77–82.

Ivanchev, Sv. (1957/1978), Nablyudenia varhu upotrebata na chlena v balgarskia ezik, in P. Pashov (Ed.), *Pomagalo po balgarska morfologia. Imena*. Nauka i izkustvo, Sofia, pp. 186–211. Иванчев, Св. (1957/1978), Наблюдения върху употребата на члена в българския език, П. Пашов (редактор): *Помагало по българска морфология. Имена*., Наука и изкуство, София, 186–211.

Kohtz, L. and Niebuhr, O. (2013), Eliciting speech with sentence lists — a critical evaluation with special emphasis on segmental anchoring, *Proc. Interspeech* 2013, pp. 563–567.

Ladd, R. D. (1996). *Intonational Phonology*. Cambridge University Press, Cambridge (2nd edn. 2008).

Ladd, D. R. and Schepman, A. (2003), Sagging transitions" between high pitch accents in English: Experimental evidence, *Journal of Phonetics* 31, pp. 81–112.

Mahrova, T. (1978), Za intonatsionnite konstruktsii, *Balgarski ezik* 4, pp. 303-312. Махрова, Т. (1978), За интонационните конструкции, *Български език* 4, 303–312.

Misheva, A. (1991), *Intonatsionna sistema na balgarskia ezik*, BAN, Sofia. Мишева, А. (1991), *Интонационна система на българския език*, БАН, София.

Misheva, A. and Nikov, M. (1998), Intonation in Bulgarian, in D. Hirst and A. Di Cristo (Eds.), *Intonation Systems: A Survey of Twenty Languages*. Cambridge University Press, Cambridge, pp. 275–287.

Nikolaeva, T. (1977), *Frazovaja intonacija slavjanskix jazykov*, Nauka, Moskva. Николаева, Т. (1977). *Фразовая интонация славянских языков*, Наука, Москва.

Oliver, D. and Andreeva, B. (2008), Peak Alignment in Broad and Narrow Focus. A Cross-language Study, in G. Zybatow, L. Szucsich, U. Junghanns and R. Meyer (Eds.), *Formal Description of Slavic Languages: The Fifth Conference (FDSL5), Leipzig 2003*. Peter Lang, Frankfurt am Main, pp. 134–148.

Penchev, Y. (1980), *Osnovni intonatsionni konturi v balgarskoto izrechenie*, BAN, Sofia. Пенчев, Й. (1980), *Основни интонационни контури в българското изречение*, БАН, София.

Pierrehumbert, J. (1980). *The Phonetics and Phonology of English Intonation*. MIT Press, Cambridge/MA.

Pierrehumbert, J. and Hirschberg, J. (1990), The meaning of intonational contours in the interpretation of discourse, in Ph. R. Cohen, J. Morgan and M. E. Pollack (Eds.), *Intentions in communication*, MIT Press, Cambridge/MA, pp. 271–311.

Pike, K. L. (1945), *The Intonation of American English*. University of Michigan Press, Ann Arbor.

Popov, K. (1963), *Savremenen balgarski ezik. Sintaksis*, Nauka i izkustvo, Sofia. Попов, К. (1963), *Съвременен български език. Синтаксис*, Наука и изкуство, София.

Stoykov, Stoyko (1942), Balgarski knizhoven izgovor. Opitno izsledvane, *Sbornik na balgarskata akademia na naukite i izkustvata* 37 (3), pp. 281-415. Стойков, Ст. (1942), Български книжовен изговор. Опитно изследване. *Сборник на българската академия на науките и изкуствата* 37 (3), 281–415.

Stoykov, St. (1966), *Uvod vav fonetikata na balgarskia ezik*, Nauka i izkustvo, Sofia. Стойков, Ст. (1966), *Увод във фонетиката на българския език*. Наука и изкуство, София.
Themistocleous, Ch. (2016), Seeking an Anchorage. Stability and Variability in Tonal Alignment of Rising Prenuclear Pitch Accents in Cypriot Greek, *Language and Speech* 59(4), pp. 433–461.
Tilkov, D. (1981). *Intonatsiyata v balgarskia ezik*, Narodna Prosveta, Sofia.Тилков. Д. (1981), *Интонацията в българския език*, Народна просвета, София.
Trager, G. L. and Smith, H. L. (1951). *An Outline of English Structure*. Battenburg Press.
Welby, P. and Lœvenbruck, H. (2005), Segmental "anchorage" and the French late rise. *Proc. Interspeech* 2005, pp. 2369–2372.
Welby, P. and Lœvenbruck, H. (2006), Anchored down in Anchorage: Syllable structure and segmental anchoring in French, *Italian Journal of Linguistics / Rivista di linguistica*, Pacini Editore S.p.A, 2006, 18, pp. 74–124.

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