PERCEPTUAL CUES TO DIFFERENT DEGREES OF PHONETIC PROMINENCE IN LARGE UNITS OF SPEECH

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ABSTRACT

The present study aims to establish the most frequently used perceptual cues (and their combinations) to high degree of phonetic prominence (HDP) and low degree of phonetic prominence (LDP) in large units of speech – in this paper they are referred to as 'phrases' and 'phonetic paragraphs'. The language under investigation is Standard British English. The results of the perception experiment suggest that the most frequently used perceptual cues to HDP in both phrases and phonetic paragraphs include tempo, pitch range, and degree of articulatory effort. Tempo was found to be the most frequently used parameter signalling LDP. The number of combinations of phonetic parameters used to create HDP is rather limited compared to the number of combinations of phonetic parameters used to create LDP. Our material suggests that it normally takes more phonetic parameters to create HDP than it does to create LDP. The effect of LDP can be achieved by modulations of only one parameter – tempo or a combination of tempo and degree of articulatory effort, whereas HDP is typically created by modulations of three parameters.

Keywords: phonetic prominence, degree of prominence, perceptual cues, speech units

1. INTRODUCTION

Units of speech vary in their perceptual prominence. In the chain of continuous speech, the pronunciations of some elements are made to stand out while the pronunciations of others are made 'to stand back'. Otherwise stated, speech is a constant alternation of elements of different degree of phonetic prominence.

Most studies exploring phonetic (acoustic and perceptual) correlates of prominence have concentrated on minimal units of speech: sounds or syllables [2, 4, 6]. Word prominence, too, have not infrequently become the subject of phonetic research [1, 5]. Surprisingly few studies, though, have looked at phonetic prominence as the property of larger chunks of speech. Nothing is known about what phonetic parameters are most frequently used to create different degrees of prominence in units of speech larger than intonational phrases (IPs). In the Russian phonetic tradition they are usually referred to as 'phrases' proper and 'phonetic paragraphs'. Zlatoustova, et al. [8] define a phrase as the basic unit of oral communication. Phrases express complete thoughts and thus roughly correspond to sentences, the basic units of written communication. A phrase may consist of one or more IPs. A group of phrases addressing the same topic constitute a phonetic paragraph.

The present study seeks to find the most frequently used perceptual cues (and their combinations) to different degrees of prominence in phrases and phonetic paragraphs. By prominence we mean the property of large chunks of speech constituting a whole IP, a sequence of IPs or a phrase proper. The choice is made between four parameters: tempo, loudness, pitch range, and degree of articulatory effort. This is by no means a complete list of all possible perceptual cues to prominence. Rather, it is an optimized set of cues. The results of the previous research in the field suggest that differences in tempo, loudness, pitch range, and degree of articulatory effort are closely associated with speech fragments of different relative importance and, consequently, of different degree of phonetic prominence [10, 11]. These differences are also easy to perceive and, more importantly, easy to produce (if we are to use the results of the present study in ELT). This explains the reason why we confined ourselves to these particular phonetic parameters.

2. PERCEPTION EXPERIMENT 1

The perception study reported in this paper combines two experiments. The purpose of perception experiment 1 was to single out elements of HDP and LDP from two types of speech units – phrases and phonetic paragraphs – ignoring particular parameters creating these effects. Naive

listeners unaware of the phonetic nature of the phenomenon in question were thought to cope best with the task.

The elements singled out by the majority of subjects were then to be analyzed in perception experiment 2.

2.1.   Materials

Three texts were selected for the analysis. They were recorded by the British actor, writer, and broadcaster Stephen Fry for his personal website www.stephenfry.com (the so called 'podgrams'). The total duration of the recordings is 94 minutes. The texts refer to the functional style of journalism. It is in this functional style that we can expect a great deal of variation in the degree of phonetic prominence [9].

After deciding on the texts we set out to select particular fragments for the analysis – phrases and phonetic paragraphs. We looked for phrases containing parentheses (Type 1) or homogeneous parts (Type 2) and phrases with perceived phonetic differences between thematic and rhematic parts (Type 3). The results of the previous research in the area suggest that parentheses and long strings of homogeneous parts are often characterized by LDP [9]. It is common knowledge that thematic and rhematic parts of a sentence receive different degrees of phonetic prominence: rheme expressing new or most important information is typically characterized by HDP, while theme associated with old or unimportant information normally receives LDP [3].

When selecting phonetic paragraphs we sought to find units with easily identifiable hyper-rhemes and hyper-themes expressed by whole phrases (not parts of phrases). As well as rhematic and thematic parts of a phrase, hyper-rhematic and hyper-thematic parts of a paragraph are normally characterized by HDP and LDP respectively.

The result of the selection process was a total of 26 utterances (they were taken from the texts we had selected earlier): 19 phrases (cf. audio files 1-19) and seven paragraphs (cf. audio files 20-26). They were cut out from the recordings in PRAAT (v.5.1.3.0) and saved as separate WAV files.

2.2.   Subjects

A total of 17 subjects recruited from undergraduates at Lomonosov Moscow State University participated in perception experiment 1. All of them were non-native speakers of English.

None of the subjects had any known history of hearing disorders or received any prior training in phonetics.

2.3.   Procedure

The subjects were seated in a language laboratory Sanako Lab 200 (Tandberg TLC1000) and given cards with the transcripts of the recorded fragments. A short discussion of the meaning of the term 'prominence' preceded the experiment. Yet, no mention was made of any particular phonetic parameters that can be used to create prominence. The subjects were not told of the specific purposes of the experiment. Their task was to listen to the recordings through headphones and highlight fragments of HDP and LDP on the respective cards. When listening to phrases the subjects were to look for more or less long (longer than a word) speech units characterized by the same degree of phonetic prominence. When listening to phonetic paragraphs they were to focus on whole phrases (sentences), not their parts. To ensure accuracy, the subjects were encouraged to play the recordings as many times as they needed.

2.4.   Data analysis

2.4.1. Phrases

Type 1: In seven out of eight Type 1 sentences parentheses were perceived by the majority of the subjects as having LDP. Type 2: Homogeneous parts in two out of seven Type 2 sentences were perceived by the majority of the subjects as having LDP. Homogeneous parts in three other sentences were perceived as having HDP. Type 3: In eight out of eight Type 3 sentences the rhematic parts were perceived by the majority of the subjects as having HDP.

2.4.2. Phonetic paragraphs

Ten phrases were perceived by the majority of the subjects as having HDP. Five of them were perceived as having LDP.

There were five other phrases that most of the subjects commented on. They contained speech chunks of various length (longer than a word) characterized by LDP.

2.4.3. Total number of fragments

This gave us a total of 37 fragments for the analysis. 19 of them were characterized by LDP (5 phrases and 14 parts of phrases – IPs or sequences

of IPs) and 18 – by HDP (10 phrases and 8 parts of phrases).

3. PERCEPTION EXPERIMENT 2

The purpose of perception experiment 2 was to establish the most and the least frequently used perceptual cues (and their combinations) to HDP and LDP.

3.1. Materials

The fragments of HDP and LDP (15 phrases and 22 parts of phrases) singled out in perception experiment 1 were used for the analysis.

3.2. Subjects

A total of 17 subjects took part in perception experiment 2. All of them were English professors familiar with phonetic terminology.

3.3. Procedure

The subjects were asked to assess the fragments in terms of four parameters – tempo (T): fast/normal/slow, loudness (L): loud/normal/soft, pitch range (P): wide/normal/narrow, and degree of articulatory effort (A): high/normal/low. The results were to be put into a table. In fragments of LDP we expected increased tempo, decreased loudness, narrow pitch range, and low degree of articulatory effort resulting in vowel reduction. Slow tempo, increased loudness, wide pitch range, and high degree of articulatory effort ('overarticulation') were assumed to characterize fragments of HDP. If a certain parameter was assessed by a listener as 'normal' it was thought to be irrelevant to the creation of this or that degree of prominence.

4. RESULTS AND DISCUSSION

The results of the perception study reported here suggest that the effect of HDP both in phrases and in phonetic paragraphs can be achieved by three combinations of phonetic parameters. Tables 1 and 2 show these combinations and their frequencies of occurrence.

As is clear from the tables, the most common scenario for both units of speech is slow tempo, wide pitch range, and high degree of articulatory effort. Increased loudness can also contribute to the creation of the effect of HDP. Yet, HDP does not necessarily involve increased loudness. In fact, it is not uncommon for an element pronounced in a

low voice to be perceived as having HDP. In our study there were two examples proving this point.

Table 1: Combinations of perceptual cues to HDP in phrases.

№	Combination of cues	Frequency, %
1	T+P+A	50
2	T+L+P+A	25
3	P+A	25

Table 2: Combinations of perceptual cues to HDP in phonetic paragraphs.

№	Combination of cues	Frequency, %
1	T+P+A	70
2	T+L+P+A	30

Having considered the frequency of occurrence of each of the four analyzed parameters in the established combinations (see Tables 1 and 2), we identified the most and the least frequently used cues to HDP. Figure 1 illustrates the obtained results: tempo, pitch range, and degree of articulatory effort as the most frequently used perceptual cues (with only a slightly lower frequency of occurrence of tempo), and loudness as the least frequently used one.

Figure 1: The most and the least frequently used perceptual cues to HDP in phrases and phonetic paragraphs.
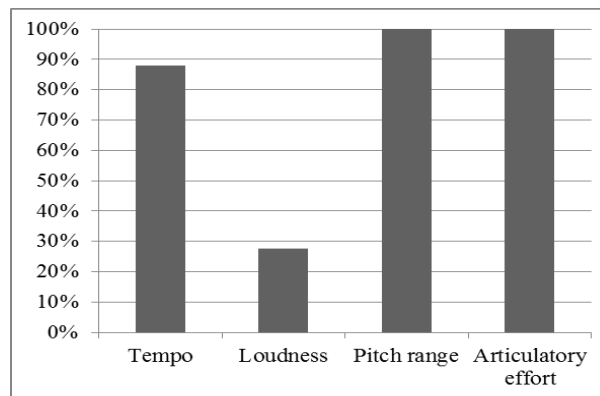

Table 3: Combinations of perceptual cues to LDP in phrases.

№	Combination of cues	Frequency, %
1	T+L+P+A	14,3
2	T+L+A	14,3
3	T+L	14,3
4	T+A	14,3
5	T	14,3
6	T+L+P	7,2
7	T+P+A	7,2
8	T+P	7,2
9	L+P	7,2

Table 4: Combinations of perceptual cues to LDP in phonetic paragraphs.

№	Combination of cues	Frequency, %
1	T+A	40
2	T+L+P+A	20
3	T+L+A	20
4	T	20

The results of the perception experiment reveal that the effect of LDP both in phrases and in phonetic paragraphs is created by a large number of combinations of phonetic parameters (see Tables 3 and 4). The exact number of these combinations in our study was nine. It stands in contrast with only three combinations of cues to HDP.

One of the most frequently used combinations of cues both in phrases and in phonetic paragraphs include from three to four parameters. It is not infrequent, though, that LDP is achieved by modulations of only one or two parameters (most commonly, it is tempo or tempo + degree of articulatory effort). It is true in 57,2% of cases in phrases and in 60% of cases in phonetic paragraphs. This is another point of difference between LDP and HDP: HDP is normally achieved by modulations of at least three parameters (50% of cases in phrases and 70% of cases in phonetic paragraphs).

As shown in Figure 2, tempo was found to be the most frequently used cue to LDP in both types of speech units. Loudness and degree of articulatory effort were found to be less frequently used. Pitch range appeared to be the least frequently used cue to LDP.

Figure 2: The most and the least frequently used perceptual cues to HDP in phrases and phonetic paragraphs.
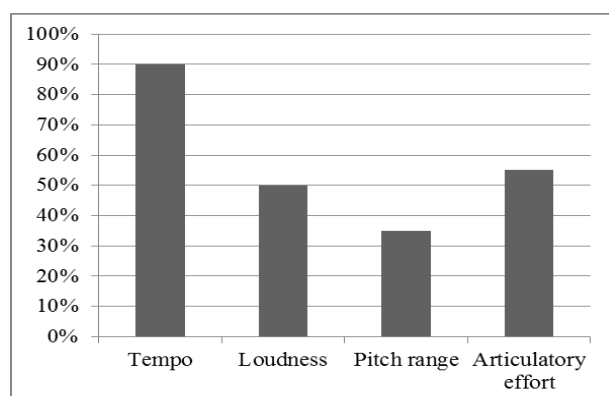
5. CONCLUSIONS

The results of the present study reveal that the most frequently used perceptual cues to HDP in both phrases and phonetic paragraphs are tempo, pitch range, and degree of articulatory effort. Loudness was found to be the least frequently used cue to HDP. The most frequently used perceptual cue to LDP in both types of speech units is tempo. Loudness and degree of articulatory effort are used less often. Pitch range contributes to the creation of the LDP effect very seldom.

The number of combinations of phonetic parameters used to create HDP is rather limited compared to the number of combinations of phonetic parameters used to create LDP.

Our material suggests that it normally takes more phonetic parameters to create HDP than it does to create LDP. The effect of LDP can be achieved by modulations of only one parameter – tempo or a combination of tempo and degree of articulatory effort, whereas HDP is typically created by modulations of three parameters.

We realize that our material is not comprehensive enough to make any fundamental conclusions but it definitely warrants further investigation.

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