6.6. PERCEPTION OF ACOUSTIC CHARACTERISTICS OF WORD STRESS IN ENGLISH AND UKRAINIAN

The problem of word stress cannot be solved finally by describing objective acoustic correlates of word stress alone.

It is just as important to determine what subjective characteristics make it possible for a human being to distinguish between stressed and unstressed syllables.

Since the research into the perception of stressed and unstressed syllables was the object of the given paragraph, some auditory experiments were carried out.

Twenty isolated English words read as vocabulary units were singled out of ten accentual pairs of similar sound compositions and were presented to ten listeners whose native language was English. Similar twenty isolated words read by Ukrainian speakers were presented to ten listeners, whose native language was Ukrainian.

As pointed out above total acoustic energy – the result of coordinated action of intensity and duration is the main physical cue of stressed syllables in English and Ukrainian. Changes in the components of acoustic energy – intensity and duration may cause changes in the perception of syllables as stressed or unstressed. An opinion was expressed by some linguists that frequency may also distinguish a stressed syllable from the unstressed one. However, it has been proved in the preceding paragraphs that neither the height of the tone nor the deviations from its level could be considered the characteristics of word stress in English and Ukrainian.

In the course of auditory analysis the listeners had to take into account the subjective characteristics of stressed and unstressed syllables and to define them.

While listening to speech the listeners succeed in distinguish stressed and unstressed syllables of the word due to the acoustic cues of the stressed and unstressed syllables that are relevant on the word stress level in the given language. Different languages, naturally, may have different acoustic cues and consequently, different recognition routines.

It should be noted that listeners reserve their final decision on the recognition of stressed and unstressed syllables until they perceive the entire word, i.e. they

perceive the phonetic structure of the word as a whole. In view of this, it is especially important to examine absolute and perceived acoustic characteristics of stressed and unstressed syllables and examine their relationship in the experimental words. Since stressed and unstressed syllables are determined by means of the subjective criteria in this paragraph it is important to take into consideration what the subjective criteria, distinguishing the stressed syllable from the unstressed one may be:

- **strength** of the syllable corresponds to the objective characteristic of total acoustic energy;
- **loudness** of the syllable corresponds to the objective acoustic characteristic of intensity;
- **length** of the syllable corresponds to the objective acoustic characteristic of duration;
- **pitch** of the syllable corresponds to the objective acoustic characteristic of fundamental frequency;
- **weight** of the syllable.

The results of the auditory analysis revealed a close correlation between the primary objective physical parameter of word stress – total acoustic energy and subjective perceptual characteristic – strength.

The stressed syllables were perceived by the subjects as stronger than the corresponding unstressed syllables in 98.5 % of cases in the English speech and in 96.4 % of cases in the Ukrainian speech.

The auditory analysis revealed that there exists a correlation between the objective quantitative acoustic characteristics of components of word stress – intensity and duration and their subjective qualitative perceived characteristics – length and duration.

Objective parameter of intensity is perceived by a human ear as loudness. The stressed syllables are perceived louder than the unstressed ones. As well as intensity is an important objective component of the total acoustic energy, loudness is an important subjective component of strength of stressed syllables.

The share of loudness in creating the impression of strength of stressed syllables is bigger in English than in Ukrainian (76 % of cases in English and 46 % of cases in Ukrainian were perceived as louder ones).

Objective parameter of duration is perceived by a human ear as length.

As well as duration is an objective component of total acoustic energy length is a subjective component of strength.

The share of length in creating the duration of stressed syllables is very important in the Ukrainian language.

The listeners registered 68.6 % of cases when the stressed syllables were longer than the unstressed ones in Ukrainian. This result supported the conclusion that duration on acoustic level and length on the level of perception are the leading components of the main acoustic characteristic feature of stressed syllables – the total energy in Ukrainian. As a result of auditory analysis 72.1 % of stressed syllables were perceived by the subjects as longer than the correspondent unstressed in English and 68.6 % in Ukrainian.

This conclusion contradicts the results of the objective acoustic analysis of duration which stated that the primary component of the total acoustic energy in English was intensity, and duration was a component of minor importance.

Longer length of English stressed syllables on the level of perception may be explained not as much by the effect of word stress as by the existence of long vowel phonemes in the phonematic system of the English language. This suggestion may be supported by a bigger coefficient of correlation between the intensity of stressed and unstressed syllables, while in Ukrainian it is considerably smaller.

Subjective characteristics of the height of tone or pitch as well, as the objective characteristics of the fundamental frequency, proved that they were insignificant in differentiating both English and Ukrainian stressed and unstressed syllables. The higher pitch of voice of stressed syllables was not significantly bigger than that of the corresponding unstressed ones and was perceived by the listeners as higher in pitch in 25.2 % of cases in English and 19.5 % in Ukrainian and consequently, could not be considered characteristics of word stress on subjective level too.

The concept of syllable weight, grounded on phonetic considerations, was developed by M.K. Gordon in his thesis for a doctor's degree in 1999. According to M.K. Gordon syllable weight, as well as the weight of other phonetic phenomena, is a language property. The results of his survey confirmed the hypothesis that weight was shown to have different dysfunctions in different phonetic processes. Syllable types according to this theory may belong to the light or to the heavy ones in weight. Unstressed syllables are perceived as light in weight, stressed syllables are heavy in weight.

Auditory analysis revealed that while evaluating syllables from the viewpoint of the sensation of their weight, many subjects came to the conclusion that stressed syllables were perceived as more "weighty" and more "heavy" than the unstressed ones. 52.8 % of cases the subjects perceived the stressed syllables as more weighty in English and 46.2 % in Ukrainian.

A big number of cases when stressed syllables were perceived as more weighty make it possible to suggest that weight may be the third component of total energy caused by the strength of sounds or by bioelectric activity of the speech producing muscles, but these are just suppositions and nothing is yet known about the objective correlate of weight.

The concept of weight is a new scientifically interesting notion and requires further elaboration (table 6.19).

Table 6.19

Perceptual acoustic characteristics of stressed and unstressed syllables in English and Ukrainian

Perceptual characteristics of stressed syllables in comparison with unstressed ones	Number of cases of prevailing perceptual characteristics of stressed syllables (%)	
	English	Ukrainian
Strength	98.4	96.7
Loudness	76.5	46.0
Length	71.2	68.6
Pitch	25.2	16.5
Weight	52.8	46.2