

THE RELEVANCE OF THE NOTION "BASIS OF ARTICULATION" TO CONTRASTIVE PHONETICS

JANINA OZGA

The Jagellonian University of Cracow

For the purposes of this paper the following definition of the "basis of articulation" (called also "articulation basis" or "base") will be adopted: *the system of characteristic articulatory movements of a given language that confer upon it its general phonetic aspect* (Chomsky and Halle 1968:295, after Marouzeau 1943:38).

To justify the incorporating of the notion into contrastive analysis on the phonological plane I shall attempt to demonstrate that:

1. contrastive (pedagogical) analyses which do not account for differences between the articulation bases of the languages compared, i.e. do not include descriptions and comparisons of those composite articulatory actions in their *totality*, do not capture an important aspect of the differences in the phonetic nature of the languages and are, therefore, incomplete;

2. teaching programmes based on such incomplete contrastive analyses cannot assure a fully satisfactory mastery of the target language pronunciation (Honikman 1964:74) says in this context: "... where two languages are disparate in articulatory setting, it is not possible completely to master the pronunciation of one whilst maintaining the articulatory setting of the other");

3. the acquisition of the articulation basis of the target language constitutes an important step towards eliminating "foreign accent". (Indeed, it can be learnt by an average learner in a very short time, which, in view of the general emphasis on cost effectiveness, cannot be disregarded).

None of the above claims can be proved unless a definition is given of the set of parameters from which descriptions of articulation bases are generalized. In order to abstract, as it were, those parameters from the phonetic substance of languages let us start by examining the pedagogical situa-

tion, the argument for such procedure being that, through the elimination of factors that are included in any standard contrastive treatment of the pronunciation of a foreign language, it is possible to arrive at that residue which had best be discussed under the general heading of the basis of articulation. The "standard" approach appears to be based on phonemic analysis and the ensuing discussion will refer mostly to that framework. It may be that generative phonology will either supplement it or supplant it (and the basis of articulation will be described in a "metarule" of the type suggested by Kim 1972); I believe, however, that the practical descriptions of the articulation basis will be formulated in much the same way, whatever their underlying theoretical framework.

The aspect of pronunciation which is given priority in all foreign language courses is the acquisition of the phonological distinctions of the target language, i.e., the suppression of phonological interference. That involves, in terms of articulation, the mastery of the principal variants of particular foreign phonemes and of those prosodic features that are functional (i.e., distinctive) in the communicative sense. In the "minimum" programmes which aim primarily at achieving the ability to communicate in the foreign language, the phonetic means used to maintain the phonological distinctions of the target language are not particularly important. As Abercrombie (1967:5) puts it,

"... a medium is far from completely absorbed by being a vehicle for a specific language. There is always a certain amount of play, as it were, within the limits of the patterns; all that is necessary for linguistic communication is that the contrasts on which the patterns are based should not be obscured."

Thus, as long as e.g. the four German phonemes /c/, /ε/, /ø/, /œ/ are not all realized by the Polish learners as [ε], or English /θ/ is not realized as [s] or [f] (cf. *thin*, *sin*, *fin*) or *send* is not confused with *sent*, there is quite a wide margin of acceptable realizations. These are usually the native "equivalents", e.g. the Polish rolled [r] used for the English continuant [r], or in the case of "unfamiliar" sounds — approximations, e.g. [ø] used for the English [ə:] and interdental instead of dental [θ]. Such realizations might be called compensatory, as the mechanism of their formation resembles that of compensation in pathological speech of native speakers (see Drachman 1969).

The learner who by some means, such as above, has mastered the phonological distinctions of the foreign language during a "minimum" programme, will be able to communicate with the native speakers (i.e., will be understood — his own comprehension is not really ensured), but will have a more or less pronounced "foreign accent". Most language courses, however, aim at a degree of phonetic accuracy and contrastive analysis is concerned with that aspect of pronunciation, to optimize communicativeness and add natu-

ralness to the learner's utterances in the foreign language, in other words, to reduce the heaviness of the foreign accent.

The question of what constitutes the "accentless", natural speech (i.e., "consonant with the character of the language; instinctively felt and recognized by the native to be right; unexaggerated" (Honikman 1964: 83)) is best answered by reference to *phonetic norms* of a language or language variety. The word "norm" in this sense has been well described by Dłuska with reference to a certain prosodic feature of Polish, which is non-distinctive but

"... normalny w sensie stałego występowania. ... Ta norma umożliwia przeciwstawienie jej tego co nią nie jest, umożliwia zaistnienie deformacji, a dalej ocenę ich jako ekspresywnych lub jako obcojęzycznych względnie w ogóle pozajęzykowych." (1957: 113, 115).

Phonetic norms are then abstractions from the utterances of particular speakers of a given language variety, which summarize the non-functional, i.e., redundant, phonetic features of that variety. When we consider Abercrombie's remark about the "play" within the limits of the language patterns, we must remember that it is not totally a game without rules. Each language has its own phonetic (articulatory) redundancies (though there are certain universal conventions involved — see e.g. Stample 1969, Drachman 1970). The norms have to be extracted from individual realizations: what we actually hear is the realization of norms, the core common to all non-pathological speakers, with a wealth of idiosyncratic features superimposed on the core (lisping, nasal speech, adenoidal speech, creaky voice, permanent labialization, flattening of vowels, etc.) — all those individual characteristics that are either innate, habitual or cultivated. However, the establishing of norms to be studied for descriptive, contrastive, or elocutionary purposes is greatly facilitated by the speakers' *awareness* of the norms: even without any particular training they are able to separate acceptable realizations of the norms from those that exceed the limits of acceptability ("hypercorrections", speech defects, even such deviations that would not be classed as pathological by speech therapists). A representative set of the pronunciations considered to be the most "normal" is taken as the basis for study.

A standard contrastive approach to the teaching of the phonetic norms of the language to be learnt might be called atomistic or postural; although it accounts for some aspects of speech dynamics (coarticulations, assimilations, prosodic features), it is mainly concerned with giving details of the formation of both the principal and positional variants of phonemes and their distribution. Also, it is often assumed that no special teaching is required in the case of those sounds and prosodic patterns which are more or less the same as those of the native language. Thus Morciniec and Prędotą (1973:19) write:

„porównawcza analiza fonetyczna języka polskiego i niemieckiego wykazuje, że niektóre głoski obu języków są, praktycznie biorąc, takie same, że takie same są niektóre połączenia, określone prawą asymilacji, czy wreszcie pewne typy akcentuacji i intonacji. Uczeń polski nieświadomie, bez żadnych specjalnych wyjaśnień i ćwiczeń, głoski te będzie wymawiał poprawnie. Nauczanie tych głosek jest więc niepotrzebne”.

Consider, however, the following remark by Szulc (1969:40).

„Nader rzadko zdarza się ... aby dwa alofony, należące do dwu różnych systemów językowych, miały identyczną artykulację. Dzieje się tak dlatego, że nie ma w zasadzie dwu języków o tych samych *ogólnych tendencjach artykulacyjnych*”.

The awareness of “general articulatory tendencies”, which influence all segments of utterances in a given language and add a layer of phonetic features superimposed on the sequences of postures (not entirely identifiable with assimilations, coarticulations and prosodic features, though), is occasionally voiced in manuals of pronunciation, e.g. “German must be spoken vigorously...” (Kurtz and Politzer 1966:5, quoted after Kelz 1971:206); “... Proper French pronunciation is achieved only by more vigorous articulation and much greater use of lip muscles than for American English” (Ketcham and Collignon 1961:XII, quoted after Kelz 1971:207). In most textbooks, however, such non-segmental features are either not mentioned at all or described as features of particular segments, whereupon an important and time-saving generalization is missed, by not grasping the general coordinating nature of such phenomena. These can be grasped without special instruction by people who have the so-called good ear, flair for languages and talent for mimicry — and only such “naturals” attain the near-native pronunciation of a foreign language. However, any observant layman can detect certain more obvious over-all characteristics of a particular foreign language, which is proved by such remarks as “the English don’t open their mouths when they speak” or “Russian is spoken with a grin from ear to ear”. Such descriptions, naive though they may sound, are in fact the best working definitions of the articulation bases of particular languages. Such cues about the general phonetic character of languages are used e.g. by entertainers who can speak their language with a variety of foreign accents. Utilizing such cues, while genuinely conducive to a better pronunciation, is not frequently done in language courses. Teachers are either unaware of them or regard them as tricks that are without scientific foundation, not prescribed by “the book” and therefore to be discarded.

The spontaneous divining of the articulation basis of the target language is usually prompted by both visual and auditory clues. However, the auditory effect is not a very reliable basis for imitation, because it is of necessity described in impressionistic terms which are relative and vague. Thus, if

the imitation of English is based on the auditory term “muffled”, an idiosyncratic pseudo-basis can emerge, which produces perceptual effects that are perhaps more offensive to the native ear than straightforward native basis. The ability of learners to imitate what they hear is questionable. This has been the reason why not the auditory but the articulatory basis is the older and the more familiar term. Kolosov (1971:40) suggests that in the teaching of the foreign articulation basis the auditory control should be excluded in the first stages and a series of exercises with silent articulation (“bezzvučnoye artikulirovanye”) should be devised to “implant”, as it were, the target basis by referring to *visual*, *tactile* and *kinesthetic* cues (cf. the standard audio-lingual approach to the teaching of pronunciation).

Most of what has been said so far was familiar to that generation of phoneticians who studied the problem of the articulation basis towards the end of the nineteenth century (though the notion of the phonological system was not yet in use and the instrumental methods of investigating speech production were still imperfect). Most definitions of the term were given for the purposes of language teaching, e.g.:

“Every language has certain general tendencies which control its organic movements and positions, constituting its organic basis or basis of articulation. A knowledge of the organic basis is a great help in acquiring the pronunciation of a language” (Sweet 1890:69-70).

In fact, the descriptions of the articulation bases of languages were the first attempts at contrastive analysis and it is somewhat ironical that there is any need to demonstrate the relevance of the term to such analysis. This, however, is not without reason: during the larger part of the time that has elapsed between the coining of the term by F. Franke (c. 1884) and the present day, no standardized parameters were provided for measuring the basis of articulation of a given language. Although most of the insights of the earlier phoneticians concerning the phonetic nature of languages were intuitively felt to be correct, the vagueness of some statements and random selection of parameters in the description of bases of articulation prevented the term from being seriously considered in more recent times.

More exhaustive discussions of the definitions, origin, development and application of the notion “basis of articulation” are given e.g. by Kelz (1971) and Górká (1973). At this point I shall only review the three main standpoints concerning the meaning of the term:

1. Articulation basis understood as the relative position of rest or neutral position characteristic of a particular language (“relative Ruhelage”, “Indifferenzlage”, “Sprechstellung”) as opposed to the absolute position of rest (“absolute Ruhelage”, “Atemstellung”);

2. Articulation basis understood as the position of the vocal tract just before articulation begins (“aktive Sprechbereitschaftslage”);

3. Articulation basis understood as the activity of the speech organs in the speech process ("Grundhaltung der Organe im Sprechprozess") or as habitual articulatory tendencies of the speech organs in speech.

In the earlier definitions of the basis of articulation there was naturally no reference to the phonological system (pre-phoneme era!); system is mentioned in Stopa (1948:17), where he distinguished a *systemic basis*:

„Baza systemowa: zespół tendencji lub cech wymawianiowych wynikłych z rodzaju systemu fonetycznego danego języka” — and a *pronunciation basis*:

„Baza wymawianiowa: podstawa narządów mowy widoczna już w milczeniu ale ujawniająca się najwyraźniej w momencie tuż przed otwarciem ust dla wymówienia jakiegoś dźwięku właściwego danemu językowi. Ma ona duże znaczenie praktyczne przy uczeniu języka obcego. Opanowanie tej bazy, czyli umiejętność przedstawienia organów z postawy właściwej językowi ojczystemu na postawę odpowiadającą językowi obcemu, jest równoznaczna z nabyciem tzw. «akcentu owego języka»” (Stopa 1948:16).

In Chomsky and Halle (1968:300) the term “neutral position” is taken to mean a universal position that the organs of speech assume just prior to speaking (the position for the English vowel [e] in the word *bed*); it appears then that both the position for quiet breathing and the “Sprechbereitschaftslage” are language-independent. However, there are arguments against such treatment: Annan (1971:18) gives evidence for the language-specific character of the neutral position by examining the so-called “vocalic filled pause” in various languages (“... in my native Scots /ü/ or /e/ dependent on dialect or accent, Erse /a+/, Portuguese and Rumanian /e/, French /ø/, German and Swedish /œ/, Russian /i/ and Cameroons Pidgin /ẽ/ or /ã/”). In Polish it is, I think, a slightly nasalized /ɛ/; the English /e/ of *bed* would probably sound somewhat odd.

The position described by Chomsky and Halle may be universal at early stages of phonological acquisition, which, Drachman states, (1970:476) are: “universal and the corresponding bases of articulation for those stages are likely to show many universal traits too... As the innate phonological system interacts with the abstract system of a particular language, it conspires towards such a basis of articulation as will automatically guarantee in detail the phonetic outputs sanctioned for any given dialect or style of speech in the language acquired”.

The recent date of such publications as Drachman's (1969, 1970) or Kim's (1972) indicates a revival of interest in the notion “basis of articulation”. The development of natural phonology (see e.g. Stampe 1969) will undoubtedly provide new insights into the problem of “programme adaptations” in the vocal tract.

At the moment the most satisfactory (pedagogically) account of the

articulation basis is to be found in Honikman (1964). She is the only author to date who has attempted to give a description and comparison of articulatory settings of languages, which is based on a systematic examination of a definite set of articulatory parameters that can be experimentally investigated and verified. She distinguishes two articulatory settings: 1. *external* — which accounts for the over-all positioning of the lips and jaws, i.e., parts that are directly observable, 2. *internal* — “the over-all positioning of the internal mobile organs of the mouth for natural utterance” (1964:75). This is assessed by reference to the main consonant articulation (i.e., to the character of the phonological system of a language), to the position of the tongue (anchorage, tip, body, underside), and also to the state of the oral cavity — that is, to those aspects of pronunciation which are described with the help of instrumental data (X-ray tracings, palatograms, linguograms, electromyography, etc.).

To illustrate the way in which the evidence about particular elements of the settings can be collected and used in formulating the over-all articulatory specificity of a language, I shall make a preliminary examination of those elements on the basis of the relevant data from Polish. Simultaneously, a comparison with English will be made on the basis of the equivalent data from the British RP variety of English.

The data used are:

1. visual cues (about the position and “look” of lips, jaws and cheeks);
2. instrumental data (providing evidence about the internal setting);
3. sound statistics (the relative frequency of occurrence of sound-types or phonemes; will provide evidence about the influence of the sound system on both the external and internal settings).

In a full analysis of articulatory settings conclusions should be based on measurements of articulation for different subjects and then “computed to show statistical evidence” (Annan 1971:18). In the first approximation to be given here the statistical evidence is shown in terms of phonemes and only in one case are variants referred to (palatalized variants of consonants). In a more detailed study other variants will have to be considered, e.g. the two-segmental realizations of Polish nasal vowels /ẽ/, /õ/ and the calculations readjusted accordingly. In fact, a statistical analysis of phone-types may be more reliable, as phonemic interpretations which strive for symmetry and economy of notation may obscure phonetic facts (e.g. some interpretations of English diphthongs).

The external setting of Polish as compared to that of English:

Jaws

The position of jaws and their movement is to some extent determined by the frequency of occurrence of *open* vs. *close* vowels. Diagrams 1 and 2

present the frequencies of occurrence of particular vowels in English and Polish (based on the findings of Fry 1947, quoted after Gimson 1970, and of Steffen 1957). It can be seen from the Diagrams that in Polish the vowels in the half-open-to-open region predominate (/ɛ/ /a/ /ɔ/ — 69.2% of all), while in English the vowels produced in that region constitute only 24.4% of all vowels (including the four diphthongs whose first element only is found in the region considered). As Delattre (1969:2) says, "English typically centers its articulation around the neutral vowel /ə/". This means that the lower jaw is more mobile in Polish than in English, because Polish has a higher percentage of the open articulations. Visual cues confirm the statistical result. "In English", says Honikman (1964:75), "the jaw-movement is so slight and the internal setting such that the tongue is hardly ever visible during utterance". Indeed, the tongue can only be seen when e.g. /l/ is spoken by the deaf or to the deaf and the effect is very striking. The jaws in English are, then, loosely closed and "the aperture between the upper and lower teeth is generally never wide — at most about a finger's width" (Honikman 1964:80). The mobility of the lower jaw in Polish may be emphasized by the slight clenching of the jaws in palatal or palatalized articulations. The movements are not only more extensive than in English but also more energetic (cf. the combinations V+/j/ in Polish and the "unfinished" diphthongs in English).

Lips

The percentages of sounds produced with lip-rounding is low in both languages. Both English and Polish have only the front-unrounded and back-rounded series of vowels (cf. French and German); therefore the contrasting vigorous adjustment of lips is unnecessary. Rounding and accompanying protrusion is only intermittent. In English lips "mostly remain rather neutral, slightly and loosely apart, slightly cornered and with only moderate mobility" (Honikman 1964:74-5). Stopa (1948:16) remarks that English has "luźne kąty ust, wargi niemal że obwisłe".

In Polish the position of lips differs in one detail which has already been mentioned by Stopa (1948:16): "Łagodnie napięcie lekko cofniętych kątów ust" and which is also evident in the photographs of lips in Wierzchowska (1971). The pressure of the corners against the pre-molars is most noticeable in the pronunciation of palatal and palatalized consonants: it may be that this position has become habitual for all sounds (or most) but this strong claim will have to be tested.

Cheeks

In English they are neutral and relaxed; in Polish — because of the specific lip position — they appear alternately dimpled and puckered or elong-

ated (stretched downwards) for the open vowels — but the dimpling effect is the most dominant.

The internal setting of Polish as compared to that of English:

The internal setting is partly determined by the main consonant articulation. In both languages it is the articulation in the denti-alveolar region which is the most frequent (this is the case in many other languages as well). However, the percentages differ (see Diagrams III and IV); in English the predominance of the denti-alveolars is very striking (61.7% of all consonants), while in Polish their frequency is only 46.35%, or — if we subtract the palatalized variants — 45.15%. The second most frequent group in both languages is that of labials (22.32% in English and 26% in Polish). However, if all palatalized variants are added to the true palatals, then the group will become the second most frequent type with 18.4% + 5.6% = 24%, as opposed to all non-palatalized labials with 21.21%. Thus there are two forces operating on the phonetic substance of Polish; it has already been remarked that the palatal articulation has a strong influence on the articulatory parameters of non-palatals (lips, cheeks, possibly jaws — which have to be very close for palatals on account of the tongue rising to the roof of the mouth to ensure the wide articulatory contact, as shown in Wierzchowska 1971:178 "Spółgłoski miękkie").

The main *active articulator* appears to be the apex for the English sounds and predorsum for Polish (cf. Gimson 1971 and Wierzchowska 1971; especially the latter's discussion on the classification of Polish sounds according to the three basic positions of the tongue: flat, front and back, 1971:108-9).

The anchorage is in English "laterally to the roof" (Honikman 1964:81). She states: "almost throughout English, the tongue is tethered laterally to the roof of the mouth by allowing the sides to rest along the inner surface of the upper lateral gums and teeth" (1964:76).

In Polish the apex is an anchorage of sorts: for most of the time it lies behind the lower front teeth (X-ray tracings in Wierzchowska 1971, esp. 108-9). The proof that it is the best "candidate" for the function is the low distortion of sound when Polish is spoken with the apex permanently in the anchored position (cf. the higher distortion in English in such articulation).

The *body* of the tongue appears to be concave to the roof in English (very few palatal sounds, apex articulation), while it tends to be convex in Polish (the influence of palatal articulation, apex anchored to the floor of the oral cavity).

Honikman does not include the state of the glottis among the parameters. The reason for this may be that auditory adjustment is necessary in exercises on the degrees of voicing utilized by various languages. The visual, tactile, and kinesthetic pre-programming suggested by Kołosov (1971) for getting

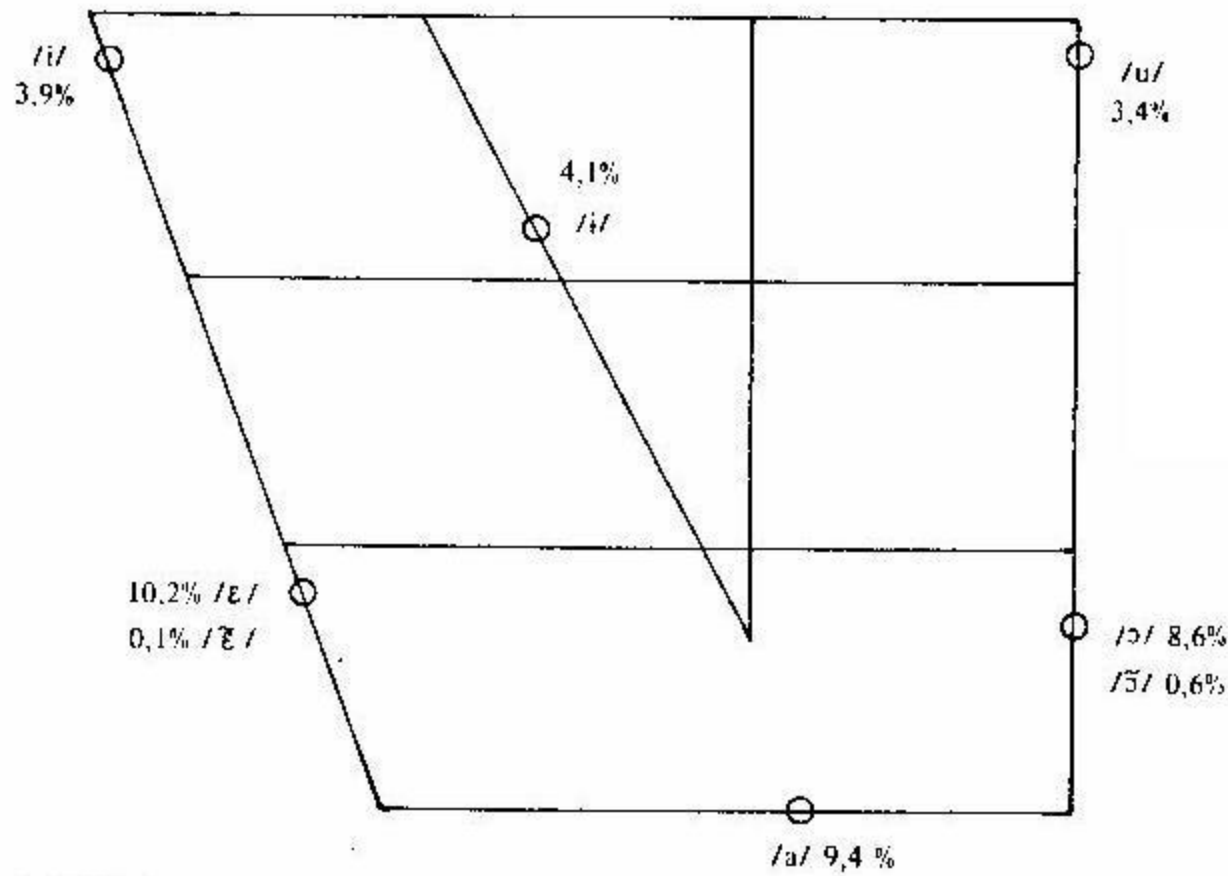


Diagram 1. Polish vowels: frequency of occurrence. Vowels in the half-open-to-open region constitute 27.9% of all phonemes, i.e., 69.2% of all vowels.

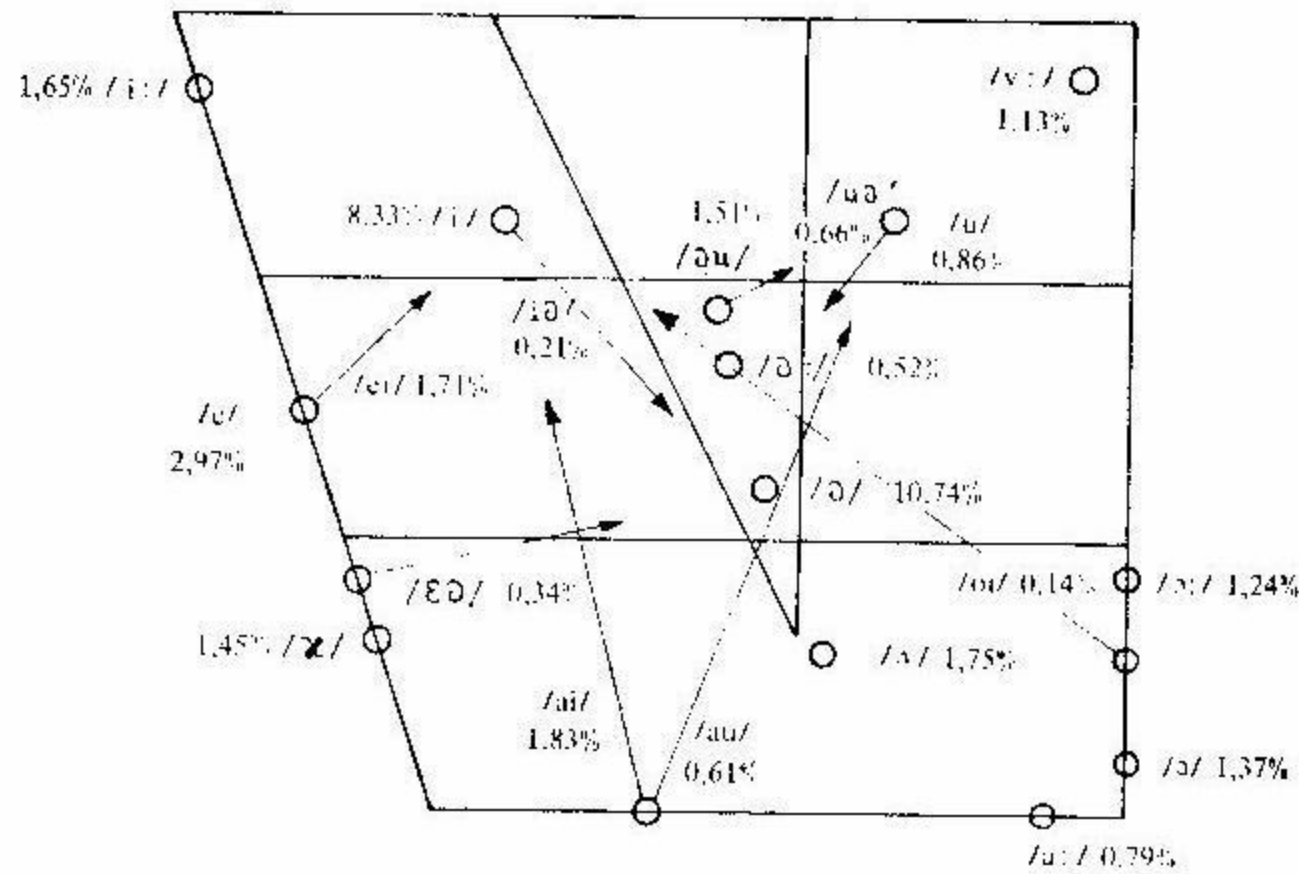


Diagram 2. English vowels: frequency of occurrence. Vowels in the half-open-to-open region constitute 9.52% of all phonemes, i.e., 24.2% of all vowels.

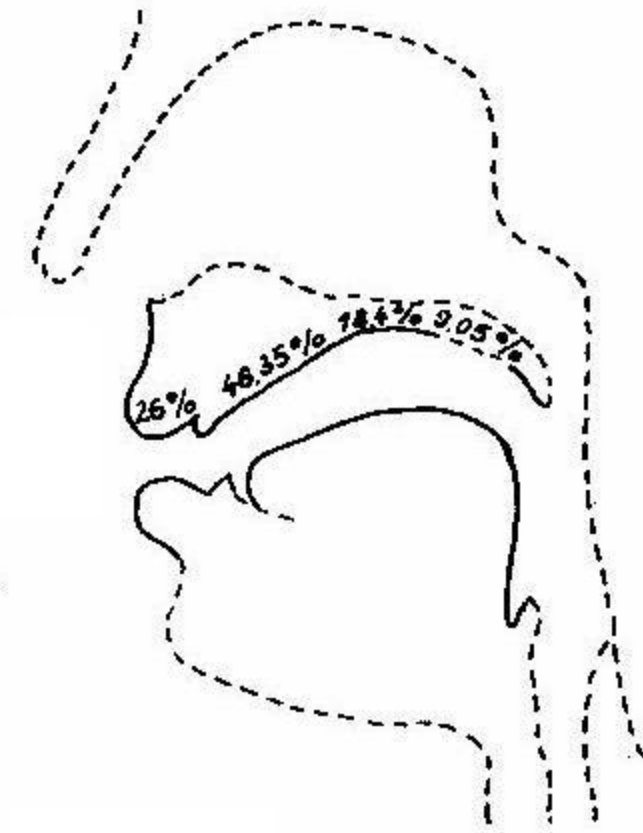


Diagram 3. Polish consonants: relative frequency of occurrence (4.26% of labials, 1.2% of dental-alveolars, and 0.14% of velars are palatalized).

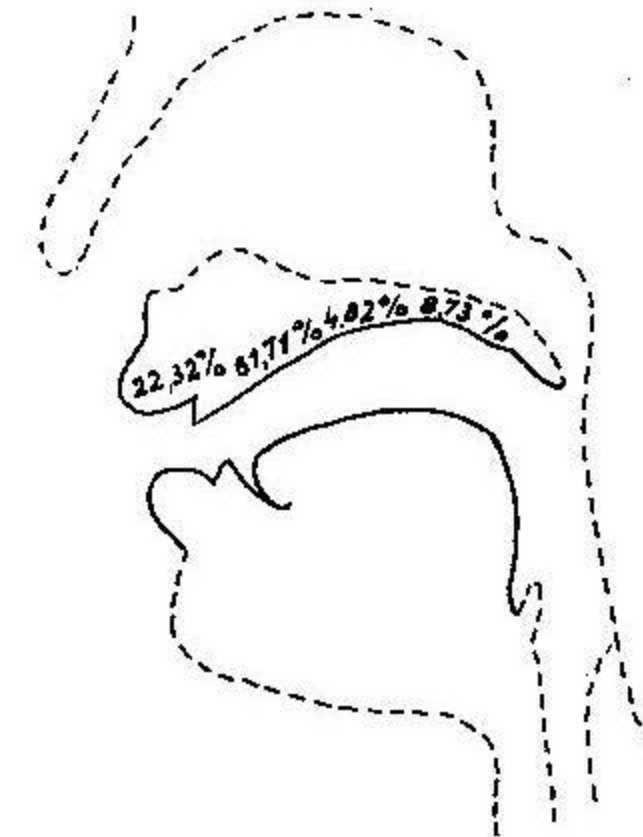


Diagram 4. English consonants: relative frequency of occurrence.

into the foreign articulatory "gear" (Honikman's term) will at some point have to be aided by auditory training. MacCarthy (1969) lists the auditory distinctions to be practised. The articulatory and auditory pre-orientation that would capture the general aspects of the pronunciation of the foreign language and instil the over-all articulatory and auditory habits of the language in the learner, would facilitate to a considerable extent the correct formation of "particular sounds". The exercises for acquiring the auditory basis remain to be prepared; those which help in acquiring the articulatory basis have already been prepared by Honikman and Kolosov. The latter reports, moreover, highly successful results in the teaching of the pronunciation of German to Russian schoolchildren (1971: 54) on the basis of an experiment in which a group of learners who had some training in German articulatory settings acquired greater phonetic accuracy and naturalness than a control group taught by standard auditory and postural methods.

The preparation of exercises for the mastery of the basis of articulation may be brought to depend on more factors than those mentioned above with the development of methods of contrastive research (see e.g. Delattre: 1969, where he lists "40 sections to be studied for contrastive purposes in phonetics"). This will be in order, provided that the final formulation presented to the learner is *simple*. Much of the appeal of the notion "basis of articulation" lies in the fact that e.g. a simple instruction like "keep your jaws closer and your lips neutral" brings evident improvement where the pronunciation of Polish learners of English is concerned.

REFERENCES

- Abercrombie, D. et al. 1964. *In honour of Daniel Jones*. London: Longmans.
 Abercrombie, D. 1967. *Elements of general phonetics*. Edinburgh: University Press.
 Annan, B. 1971. "The 'articulation base' and Chomsky's 'neutral position'". *University of Leeds Phonetics Department Report 3*. 17-20.
 Brame, M. K. (ed.). 1972. *Contributions to generative phonology*. Austin: University of Texas Press.
 Chomsky, N. and M. Halle. *The sound pattern of English*. New York: Harpre and Row.
 Delattre, P. 1969. *The general phonetic characteristics of languages*. US Department of Health, Education and Welfare. Final Report. Office of Education: Institute of International Studies.
 Dhuska, M. 1957. "Akcent i atona w języku polskim". *Studia z filologii polskiej i słowiańskiej 2*. 92-121.
 Drachman, G. 1969. "Adaptation in the speech tract". *Papers from the fifth regional meeting of the Chicago linguistic society*. 314-329.
 Drachman, G. 1970. "Rules in the speech tract". *Papers from the sixth regional meeting of the Chicago linguistic society*. 471-477.
 Fry, D. B. 1947. "The frequency of occurrence of speech sounds in Southern English". *Archives Néerlandaises de phonétique expérimentale 20*. 103-106. (quoted in Gimson 1970).

- Gimson, A. C. 1970. *An introduction to the pronunciation of English*. London: Edward Arnold.
 Górka, J. 1973. *Der Einfluß der muttersprachlichen Artikulationsbasis auf die deutsche Aussprache polnischer Sprecher*. Unpublished Ph. D. dissertation, The Jagellonian University of Cracow.
 Honikman, B. 1964. "Articulatory settings". In Abercrombie, D. et al. 1964. 73-84.
 Kelz, H. P. 1971. "Articulatory basis and second language teaching". *Phonetica 24/4*. 193-211.
 Ketcham, R. K. and J. Collignon. 1961. *Patterns of French*. New York. (quoted in Kelz 1971).
 Kim, C. W. 1972. "Two phonological notes: A-sharp and B-flat". In Brame, M. K. (ed.). 1972. 155-170.
 Kolosov, K. M. 1971. "O roli artikulac'ionnoy bazy v obučenii proiznošenyiu". *Inostrannyye jazyki v škole 5/71*. 38-45.
 Kurtz, J. W. and H. Politzer. 1966. *A comprehensive course for college students*. New York: Norton. (quoted in Kelz 1971).
 MacCarthy, P. A. D. 1969. "Sensory training: the pre-requisite for effective language learning". *University of Leeds phonetics department report 2*. 47-52.
 Marouzeau, J. 1951^a. *Lexique de la terminologie linguistique*. Paris: Geuthner.
 Morciniec, N. and S. Prędota. 1973. *Fonetyka kontrastywna języka niemieckiego*. Warszawa-Wrocław: PWN.
 Stampe, D. 1969. "The acquisition of phonetic representation". *Papers from the fifth regional meeting of the Chicago linguistic society*. 443-454.
 Steffen, M. 1957. "Częstość występowania głosek polskich". *B PTJ 16*. 145-164.
 Stopa, R. 1948. "Baza artykulacyjna a środowisko". *Sprawozdania z posiedzeń PAU*. 15-18.
 Sweet, H. 1890. *A primer of phonetics*. Oxford: Clarendon Press.
 Szule, A. 1969. *Wymowa niemiecka*. Warszawa: PZWS.
 Wierzchowska, B. 1971. *Wymowa polska*. Warszawa: PZWS.