LIST OF FREE DISCUSSION TOPICS
LISTE DES SUJETS DISCUTÉS

During the congress, two periods of two hours each have been devoted to the discussion of the following topics, submitted in advance by participants. Reports of some of the discussions are given below.

Pendant le congrès, deux périodes, de deux heures chacune, ont été consacrées à la discussion des sujets suivants, soumis à l'avance par les congressistes. Quelques-unes de ces discussions ont fait l'objet d'un compte-rendu dont le texte est donné ci-dessous.

Theory of Phonetics and Phonetic Sciences (Discussion leader: M. Onishi)

Problems of the Alphabet of the International Phonetic Association (Discussion leaders: G.H. Breckwoldt and M. Rossi)

Neurolinguistique. Hypothèses et résultats obtenus par les chercheurs dans l'étude des phénomènes centraux (corticaux) dans l'acte de parole (Discussion leader: A. Hadj-Salah)

Speech Synthesis by Rule (Discussion leaders: J.P. Köster and E.T. Purcell)

Electromyographic Techniques in Phonetics (Discussion leaders: C. Adams and J. Ohala)

Recherches sur le fonctionnement du larynx (Discussion leader: A. Fourcin)

La théorie de la syllabe (Discussion leaders: A. Rosetti and K. Köser)

Animal Vocalizations and Human Speech (Discussion leader: I. Abe)

Multidimensional Analysis of the Perception of Speech Sounds (Discussion leader: S. Singh)

Systematic Phonemics *vs.* Autonomous Phonemics. Phonemics *vs.* Generative Phonology (Discussion leaders: B. Rochet and W. von Raffler Engel)

The Experimental Study of Intonation (Discussion leader: R. Collier)

Phonological Change and Linguistic Universals. Explaining the Direction of Sound Change. Generative Grammar and Diachronic Phonology. (Discussion leaders: J. Ohala and B. Rochet)

Experimental Phonetics and Generative Phonology (Discussion leader: R. Collier)

Application des ordinateurs dans le laboratoire de recherche (Discussion leader: A. Fourcin)

Perceptual Correlates of Distinctive Features and Phonetic Terminology (Discussion leaders: S. Singh and C. Scully)

The Temporal Characteristics of Speech and Language (Discussion leaders: G.D. Allen and M.D. McClean)

Phonetics Applied to the Teaching of Languages. Generative Phonology and Teaching Problems (Discussion leaders: C. Adams, W.R.B. Annan and F. Marchessou)

Training for Field-work. Enquêtes dialectologiques (Discussion leaders: G.M. Cowan and A.M. Kinloch)

THEORY OF PHONETICS AND PHONETIC SCIENCES

Discussion Leader: M. ONISHI

Note submitted to discussion by Dr. Masao Onishi:

1. Phonetics is linguistics, and nothing else. That is to say, it is the science of speech, namely speechology, while phonetic sciences are the plural sciences as the word shows, or some adjoining sciences of phonetics proper, such as physics, physiology, psychology, pedagogy, sociology, philosophy, etc. Those sciences work from their respective academic fields to clarify the scientific 'phonetics'.

2. The fundamental difference between the two is determined by whether content exists or not at the background of sound-form, which is to be called "meaning" in another way.

3. Meaning should be divided into two, i.e. lexical-meaning and attitudinal-meaning. The former is composed of speech sounds and accentuation, while the latter is represented by intonation and prominence. Again, the former is static, expressive, while the latter is dynamic, appealing.

4. Viewed from another standpoint, speech sounds have the nature of:
   a. Quality (or timbre)
   b. Intensity (or strength)
   c. Pitch (or frequency)
   d. Length (or quantity)
   e. Emotion (or connotation)

Features mentioned in a) to d) are also found in natural sounds, such as thundering, raining, machine-noise, birds' singing, animal crying, and so forth, but those have no relationship to content or meaning, especially emotion. For example, a sound [k] may be picked up from 'cap', 'chicken', and 'look' to be abstracted into one phone [k], which might be said to represent a slice of word-meaning, but is different from natural sounds, although it may happen to be like a noise of /k/-kind resulting from cracking something.

5. Speech may be observed from two sides, as outer-phase and inner-phase, or outer-activity and inner-activity, namely phenomena in the air and image in the brain, both of which are co-ordinating or co-existing. Therefore, we may say that "speech is thinking with voice — outer phenomena" and "thinking is speaking without voice-inner image".

6. It is generally accepted that so-called "language" is viewed from two main sides, that is, the semantic side and the acoustic side related to fact in a wide sense. Should the acoustic side be represented by any intelligible term, phonetics must be the one such, inclusive of so-called phonology, phonemics, prosody, etc.

7. Some people appear to be of the opinion that phonetics treats momental, objective phenomena only, and phonology handles the continual, subjective idea of sounds. However, it seems to be a very superficial dogma, because:
   a) History in general is nothing but the piling up of momental facts, so it is the memory of human sounds which is based upon the phone phenomena.
   b) Any object in general is perceived by the human brain, and not by any other means; therefore the so-called objective judgement can be obtained as a result of the piling up of subjective judgements.

8. In current tendency, the word "perception" seems to be used to mean something visual only. Even visual observation of only graphic records requires ultimate judgement by the brain in order to form conception. It means there is no perfect borderline between Objectivity and Subjectivity. However, something objective can be obtained by repeated experiment, training, and observation.

9. Communication between speaker and hearer can only be realized by mutual cooperation. It is a matter of relative comprehension, using some specific vocal effects, if necessary.

PROBLEMS OF THE ALPHABET OF THE INTERNATIONAL PHONETIC ASSOCIATION

Discussion Leaders: G.H. BRECKWOLDT and M. ROSSI

The subject was introduced first by Prof. G.H. Breckwoldt, who criticized particularly (1) the duplicated or coexisting symbolism and (2) the incomplete and weak symbolism representing click sounds.

With regard to (1) Professor Breckwoldt quoted the coexisting

[ɪ] and [ɪ̈],
[ʊ] and [ʊ̈].

The *Maître Phonétique* has been discontinued and the new official journal of the I.P.A. has a new format. Now is the time to revise the alphabet and to adopt only one symbol of the coexisting ones. Like all other matters of I.P.A. alphabet-revision, a committee should handle the question of which symbolism will become the official one.

Professor Breckwoldt mentioned the coexisting diacritics which, according to the "Principles of the I.P.A.", both stand for centralization of a vowel, viz. [¨] and [—], e.g.:

[ö] and [ɵ]
[ï] and [ɨ]

One or two of the discussion participants declared that one symbol should denote a 'central' the other a 'centralized' vowel. This is a splendid differentiation but needs handling by the Alphabet Committee and thereafter documentation in the official organ of the I.P.A.

Professor Breckwoldt mentioned two symbols which are the same except for size, viz. the [ɤ] and the [ɣ]. If students do not pay attention to the size of the symbol they are liable to blunder, particularly in nonsense sound groups. The phonetic character [g̈] which coexists with [ɣ] could be brought up to the Alphabet Committee.

Although Professor Breckwoldt did not bring it up for discussion, he feels that the [j] and [ɹ] symbols need an official label to prevent their interchanging. Also, the [w] and [ʍ] should be examined.

A redrafting of the entire consonant chart should be considered. A classification into single approach, double approach sounds and sounds dependent on the breath and independent of the breath movement should be considered for official adoption.

With regard to item (2) the following chart will clarify Professor Breckwoldt's criticism of the existing I.P.A. click symbolism:

1971: proposed symbols and definitions		B Bilab.	Ɐ Labio-dental	D Dental	A Alveol.	Ⱥ Later. alveol.	Ᵽ (Pre) palatal	R Retroflex	undefined
1921 "L'Écriture"	symb.			ʇ		ɮ	ʗ		ʞ
	Kafir			c		x	q		
1949/70 *Principles*	symb.			ʇ		ɮ		ʗ	ʞ velar (sic!)
	Zulu			c		x		q	
1969 "Maître"	symb.			ʇ		ɮ	ʗ		
	Zulu			c		x	q		

The symbolism is obviously incomplete and has inconsistencies, viz. [ʗ, q] and [ʞ].

The click symbolism, introduced and explained in Professor Breckwoldt's congress paper "A Critical Investigation of Click Symbolism" and any other suggestions of a complete click symbolism, complying with the six rules of the "Principles of the I.P.A.", should be submitted for examination to the Alphabet Committee.

Prof. M. Rossi, the second introductory speaker, mentioned the alphabet's hesitation between phonetic and phonological criteria: affricates, for example, perhaps could be shown in different ways for the two purposes. Some diacritics were impractical, particularly if several had to be combined. Hence the reluctance of dialectologists to use the Association's alphabet. Meetings should be held jointly with romanists, dialectologists, and users of other alphabets, to solve such problems and attain uniformity. The recording of cardinal vowels made by Prof. Jones was inadequate, particularly with respect to front rounded vowels. Cardinal consonants also could well be established.

Profs. Gsell and Vinay emphasized the difficulty of persuading those committed to another form of phonetic alphabet to abandon it in favour of the Association's alphabet. Prof. Gsell continued by pointing out the need for standardization of diacritics (he disagreed with Rossi's criticism on this subject). The symbols could well be furnished with acoustic and/or articulatory illustrations to supplement the present descriptions in words. Tone marks should be revised, with high and low shown as ˊ and ˋ respectively (for phonological purposes anyhow).

Dr. J.C. Wells reminded those present of the report presented in Prague, 1967, by Prof. Gimson, on the conclusions of the committee which had been considering the desirability of changes in the Association's alphabet. He recapitulated the main points of this report.

Several participants requested that this report be published.

On the proposal of Dr. J. Catford, the following recommendation was passed *nem. con.*:

This meeting urges that the Council of the I.P.A. should take steps to implement the proposals made in the 1967 report, considering also the proposals made at the present meeting.

Minuted by G.H. Breckwoldt and J.C. Wells

MULTIDIMENSIONAL ANALYSIS OF THE PERCEPTION OF SPEECH SOUNDS

Discussion Leader: SADANAND SINGH

S. SINGH

In searching for non-arbitrary perceptual features of phonemes, multi-dimensional

techniques have been found useful. In the past, arbitrary feature systems have been used based mainly on the inspection of the clusters in a perceptual data-matrix or on the analysis of acoustic or phonological data. However, when these *a priori* feature-systems are used to predict perceptual responses, they do so with only a low degree of probability. The multidimensional scaling procedure is promising in the sense that it gives us a new start to retrieve features from perceptual data.

The MD-SCAL program of Shepard-Kruskal (Shepard 1962 and Kruskal 1964) has been used in recent years in speech research. This method (1) finds the best configuration for a fixed number of dimensions, and (2) determines how many dimensions are most appropriate for analysis of the stimuli. The dimensions of these configurations may not be interpretable because the initial coordinate system is arbitrary. A rotation programs then, may be used to aid the interpretation.

A more useful scaling technique is IND-SCAL, developed by Carroll and Chang (1970). This procedure is profitable for two reasons: (1) in addition to providing stimulus space it also provides subject (method) space on each dimension and (2) it does not require rotation like MD-SCAL does.

Precautions, however, must be taken regarding use of MD-SCAL and IND-SCAL procedures:

(1) These programs require a symmetric matrix.

(2) The Shepard-Kruskal MD-SCAL entails a problem of 'local-minima'. Therefore several runs must be obtained with the repeated occurences of a minimal 'stress'.

(3) The r-metric, e.g., City-Block or Euclidean, should be selected with care. (See Graham and House 1971 and Singh, Woods, and Tishman, in press.)

R.C. BERRY

As you may recall, I have confusion matrices for the nine English vowels for three conditions. While the elements in each matrix are the same, there are a different number of observations for each element in each matrix. Thus, my question is two-fold: (1) can multi-dimensional scaling be employed utilizing all three matrices at once or will it be necessary to do three separate analyses, and (2) if one can do one global analysis, can one convert the scores in each matrix to standard scores such as percentages or will it be necessary to do a separate analysis because of the unequal number of observations between the matrices?

S. SINGH

In the event that you chose to do IND-SCAL analysis, your three conditions could be considered as three different subjects. In this case you do not need three different analyses. If your matrices entail an equal number of speakers and listeners, you do not have to convert your score into a standard score. However, if in each condition you used a different number of speakers and/or listeners, you would have to average your scores in each condition.

R.C. BERRY

As you are probably aware, under low-pass filtering, subjects frequently confuse /i/ with /u/ but very infrequently confuse /u/ with /i/. The question is, does this new procedure require an approximately equal number of confusions in each direction?

S. SINGH

Yes it does. And in this sense you have a real problem. M. Wish of Bell Telephone Laboratories has analyzed the Miller and Nicely data by the IND-SCAL method. This data was also obtained under the filter and noise conditions. I do not know to what extent this constraint would limit your analysis. Wish's solution of the Miller and Nicely data was very nicely interpretable.

R. C. BERRY

Is there another procedure which would give the same type of information but is more appropriate for my data?

S. SINGH

I don't know. You may write to Dr. D. Carroll of the Bell Telephone Laboratories.

M. SCHWARTZ

Is there any way that I can analyze hypernasality using the multi-dimensional analysis procedure?

S. SINGH

This depends on the type of data you have and the method of analysis you choose. For example, if you have rated the nasality of a given number of subjects in the form of a symmetric matrix, you can use the IND-SCAL technique to find the stimulus space as well as the subject space. I feel this might be a very useful technique for you since you have already proposed earlier that hypernasality may be a function of four separate parameters. You will be able to test that notion.

E. FISCHER-JØRGENSEN

How were the three dimensions that you obtained in the analysis of English vowels weighted?

S. SINGH

The dimension that was interpreted as feature advancement accounted for 70% of the explained variance in the data, the dimensions that were interpreted as height and retroflexion features accounted for 13% and 17% of the explained variances respectively. The feature tenseness did not contribute anything or contributed negatively.

D. WOODS

I am not very certain of the criterion of 'normalized predictor contribution' in our vowel study (Singh and Woods, *Journal of the Acoustical Society of America* 1971). Therefore, on that point I want to differ with Dr. Singh.

E. FISCHER-JØRGENSEN

I am studying vowels on criteria such as 'light-dark' and 'compact-diffuse'. While the dimension "light-dark" seems to conform, the dimension 'compact-diffuse' does not.

H.J. PADDOCK

The suggestion that vowels are perceived in some sort of a Euclidian space corresponds to a theory of vowel perception which I have proposed in *Lingua* (25 [1970]: 142-151).

The three dimensions which I propose for this space are based on three postulated pitch features or dimensions (measured in mels). These are as follows:

(1) A-l, the pitch derived from $F1$ (= lower)

(2) A-h, the pitch from $F2 \pm$ (= *higher*)

(3) A-d, a sensation derived from the pitch difference between A-l and A-h.

The third dimension, A-d, derives from my analysis and synthesis of Russian palatalization and Arabic 'emphasis'. I find further support for this dimension in work reported by Fischer-Jørgensen, Ladefoged, and Fourcin.

Though one of my three proposed dimensions is of course (mathematically) redundant, there is plenty of evidence that all three features possess perceptual reality.

Minuted by S. Singh

PERCEPTUAL CORRELATES OF DISTINCTIVE FEATURES AND PHONETIC TERMINOLOGY

Discussion Leaders: SADANAND SINGH and CELIA SCULLY

C. SCULLY

I should like to make a plea for greater precision, even to the point of pedantry, in the use of terms describing the variables of speech at the different stages of the speech communication chain: articulatory, acoustic and perceptual.

At a different pair of stages, derivation measures for articulation need not equal those for the sounds which result. The term 'stress' is used differently by different writers to mean, on the one hand, prominence of one syllable rather than another at the perception end of the chain and, on the other hand, physiological effort at the production stage. Even intensity, which is only one of the ACOUSTIC cues for perceived stress or prominence, is equated with stress on occasions.

Terms such as 'muscle effort' and 'breath force' are perhaps too general to be really useful. At this stage we should be trying to find out which of the muscles involved in speech production operate in concert. There seems to be very little evidence at present that, when one muscle bundle is forcefully activated, all vocal tract muscles are also.

In some standard phonetic works the relationship between the articulatory and acoustic features of segments seems to be inflictively assumed to be a simple one-to-one transformation. For example, the same pair of features such as tense/lax or voiced/ voiceless is used to distinguish two segments at the acoustic or perceptual stage and those SAME two segments at the articulatory stage. Transducing from one form of encoding of speech to the next does not seem likely to prove as straightforward as this. For example, a voiced glottal adjustment may well result in an acoustically devoiced segment (see Rothenberg, M. "The Breath-Stream-Dynamics of Simple-Released-Plosive Production", *Bibliotheca Phonetica* 6, Basel, 1968).

Ideally, I believe, different terms should be used to describe articulatory, acoustic and perceptual segments. Alternatively, the accompanying word 'phone' for an acoustic segment and 'articule' for an articulatory segment might be used, as proposed recently by L.F. Brosnahan and B. Malmberg (*Introduction to Phonetics*, [Cambridge, Heffers] 1970).

S. SINGH

In perceptual literature, distinctive features have been proposed somewhat arbitrarily. The terminology used has been from the articulatory and/or acoustic domains. In our recent studies of vowels (Singh and Woods, 49 [1971]) and of consonants (Singh, Woods, and Tishman, *Journal of the Acoustical Society of America*, [in Press] and Singh, Woods and Becker, *Journal of the Acoustical Society of America*, [in Press]), we have departed significantly from the arbitrary selection of features. In other words we are proposing perceptual features that are derived from psychological data using such multidimensional analysis techniques as MD-SCAL (Shepard, *Psychometrika* 27 [1962] and Kruskal, *Psychometrika* 29 [1964]) and IND-SCAL (Carroll and Chang, *Psychometrika* 35 [1970]). These analyses provide perceptual space for phonemes which can then be grouped into different phonetic classes. Thus, in a suitable n-dimensional space, each of the dimensions (based on perceptual spacing of phonemes) can be interpreted as a feature.

H. PILCH

Could you explain the experiments?

S. SINGH

They were psychological judgments utilizing techniques of equal-appearing intervals, magnitude estimation, and triadic judgments.

H. PILCH
What languages did you use and were your vowels from the language system or were they cardinal vowels?

S. SINGH
We mainly used English phonemes. There is, however, a study using Hindi, Korean, and English stops. The vowels were language dependent; in one study, English vowels were used in isolation, in another, in context, and in a third study, English and Hindi vowels were compared.

H. PILCH
What was the outcome of these studies?

S. SINGH
The perceptual features were labeled in articulatory terms. For vowels, the features retrieved, in all conditions and in both languages, were tongue advancement and tongue height. These results confirm the earlier findings of Pols *et al.* (*Journal of the Acoustical Society of America* 46 [1969]) and Hanson (Ericsson tech. 23 [1967]). The additional in feature found with the isolated vowel was RETROFLEXION and with the vowel context was TENSENESS. The perceptual features obtained from the IND-SCAL analysis of the consonants were (1) SIBILANT, (2) PLACE (front/back), (3) VOICING, (4) PLOSIVESESS, and (5) NASALITY.

H. PILCH
I don't understand how the distinctive features fall so neatly into front/back, etc. categories. This must be due to subject bias. Also, there might be cases of auditory similarities without articulatory correspondence.

C. SCULLY
There remains the perceptual segment. I should like to support Prof. Pitch's comments about the perceptual features for vowels and consonants which emerge from, for example, Dr. Singh's very interesting results. Ideally these perceptual categories need labels which are different from the articulatory ones associated with the phonemes involved. It remains to be seen whether the terms tense/lax or fortis/lenis are of any relevance to perception. Dr. Singh's results seem to imply that possibly they may be superfluous.

K. STEVENS
I am sure you would get a different set of dimensions if you used English listeners listening to the Hindi sounds.

H. PILCH
The auditory factor of judgments depend not only on what they hear but on the listeners' background. It is, therefore, necessary to use non-language utterances. I am experimenting with auditory terminology, e.g., twang, burr, dark sound, bright sound. I find that glottalized consonants have a character which I find difficult to describe in acoustic terminology.

C.W. KOUTSTAAL
Why do you find it necessary to have different names?

C. SCULLY
Because there is not a direct correspondence between the levels of articulatory, acoustic and perceptual features. Nasality, e.g., does not tie with opening of the nasopharyngeal part. Nasality has to be auditory, purely. I think it is wrong to assume direct correspondence.

C.W. KOUTSTAAL
I can accept your (Scully) argument to a certain point. We don't yet know how perception takes place completely. Maybe we should separate the three levels, and say that there is a sibilant 1, 2, and 3 for articulatory, acoustic and perceptual correlates.

S. SINGH
I don't think it is just a quarrel of naming. The data indicates a very clear relation among these levels. A very neat distinction of consonants (front/back) appears on a perceptual dimension as well as the articulatory dimension suggesting a significant tie between the two levels.

C. SCULLY
But you mention a perceptual patterning. Why is there a need to associate it with articulatory description?

H. PILCH
My question still is whether or not the selection of five dimensios was made to fit the five *a priori* features of the consonants.

S. SINGH
No. The five-dimension analysis was suggested by Kruskal's 'stress' function as well as the high correlation in IND-SCAL analysis. The interpretation of the dimensions was based on how these sounds were spaced. The labels were attached for practical reasons. A statistician not knowing phonetics, e.g., would only say that on dimension 1, the sounds /s z ʃ tʃ dʒ/ were grouped together and distinct from all other consonants. We added the 'name' sibilant to this result.

Minuted by S. Singh