sequences of sounds. For example, the following sequence of sounds and words in Gujerati without intonation means very little. It is neutral:

vandro bet̪ho che.

But if we consider the following intonation alternances, paying special attention to the intonation difference, we make some sort of translation possible.

vandro bet̪ho che.

1. [*statement*]

The monkey is sitting down.

2. [*question*]

Is the monkey sitting down?

3. [*surprise*]

Is the monkey sitting down?

4.

Is it the monkey that is sitting there?

5.

Is the monkey **sitting** *there?*

The intonation examples just given serve to remind us what a highly abstract proceeding an alphabetic transcription of speech behaviour really is. And it is only by means of a thorough theoretical understanding of the principles and methods of the technique that we can make scientific use of such records.

In conclusion may I say that the features and examples selected for comment are intended to raise questions of general theoretical interest and to establish certain general principles for Indian phonology.

42. Dr T. Grahame Bailey (London): *The four-fold consonant system in Kashmiri.*

[ə is a high unrounded neutral vowel; when used finally without adding a syllable, it is inherent in the previous consonant.

ɜ is a low vowel of the same type, not used finally. **w** means that the previous consonant is velarized, and **y** that it is palatalized.]

Anyone seeing Kashmiri (**kʌʃmiri**) written in Roman letters and noticing the numerous tiny vowels written above the line must wonder what they are and how they are pronounced, and must be bewildered to be told that many of them are inaudible to non-

Kashmiri ears. It reminds us of the high-pitched musical notes which scientists tell us human ears cannot hear, though cats' ears can.

It is about these tiny vowels that I wish to make a few remarks to-day. In some languages the great majority of words have a vocalic ending, in others the last sound is generally consonantal. Italian belongs to the former class, while the closely allied French belongs to the latter. Often the vocalic endings indicate gender and number. Thus, to take Indian languages, in Hindi, Urdu, Panjabi, Lahndi and others, **-a** is a common masc. sing. ending, changing to **-e** for the masc. pl., **-i** for the fem. sing., and **-iã** for the fem. pl.

Kashmiri, however, prefers consonantal endings. The final vowels have been taken into the last consonant, but whereas in French they do not as a rule affect the final consonant, in Kashmiri the consonant so to speak, absorbs the vowel, and is velarized, palatalized, centralized or left neutral. This at least is the theory. In this way the **-a** ending just mentioned becomes **-ʊ**, **-e** becomes **-i**, and **-i** becomes **-ə** (for the sing.), but the noteworthy point is that these vowels are part of the consonant; they are not separate vowels. Let us take **khuːʈ**, *he feared*. In Urdu, if it existed, it would be **khutsa**, *he feared*; **khutse**, *they feared*; **khutsi**, *she feared*; **khutsĩ**, *they feared* (fem.). In Kashmiri we have **khuːʈw**, *he feared*; **khuːʈy**, *they feared*; **khuːʈ**, *she feared*. Similarly **suːzw**, *sent*; masc. pl. **suːzy**; fem. sing. **suːz**. (There are slight vowel changes accompanying the changes in the consonants.)

Let us compare this state of affairs with what we have in English. Our final plosives in English, including affricates, are generally followed by a slight vowel emission, voiced or unvoiced. Our fricatives are often treated in the same way; they may have a vowel inherent in them. Thus our words *world*, *look*, *whiff*, *rove*, to mention only four, end in a short neutral vowel, as most of our words do; the vowel is not always the same. We do not consider that this tiny vowel adds a syllable to the word. In the same way these Kashmiri vowels do not add a syllable, they are part of the consonant.

In English this vowel is generally neutral and has no semantic significance. In exceptional cases we get a velar or palatalized vowel. Thus we may encourage a sawyer by saying **pʊʃw pʊlw**, **pʊʃw pʊlw**, or call a cat by saying either **pʊsw pʊsw pʊsw** or **pʊsy pʊsy pʊsy**. This last is quite different from **pʊsɪ pʊsɪ pʊsɪ**. Kashmiri theoretically has four of these vowel endings, of which one is more correctly an absence of ending, almost the same as in English. But the Kashmiri endings are semantically significant.

The velar ending is always masc. sing., the palatalized ending is often, but not always, masc. pl. The centralized ending (a tiny **ə**) is generally fem. sing. The neutral ending, closely resembling the English one, has no significance.

Examples: **phokw**, *shoulder*; pl. **phyeky** (one syllable); **necʊvw**, *son*; pl. **necɪvy** (two syllables), *sons*; abl. sing. **necɪvɪ** (three syllables); **gʊɽw**, *horse*; pl. **gʊɽy** (one syllable), *horses*; **gʊɽɪ**, abl. sing.; **gʊɽə** (one syllable), *mare*. There is a good deal of vowel and even consonant harmony connected with these endings.

The velarized consonants, which are quite different from the Arabic velars, follow o, ʊ, u and ɔ; about 97½ per cent. following o, ʊ, u, and the remainder ɔ. Of the centralized ə endings 82 per cent. follow ɜ or ə. Kashmiri consonants are numerous; if we count the six aspirated consonants separately we get twenty-nine, and if we count the velar, palatal, central and neutral forms as separate sounds, we get 116. Actually, however, the velar, neutral and centralized consonants closely resemble each other, and we can hardly consider them all as separate sounds. In this case we get about sixty distinct consonants altogether.

I have mentioned sound harmony. These peculiar endings affect both vowels and consonants. Thus, let us take the verb ʦʌlun, *to flee*. In Hindi it is cʌlna; the past is cʌla, pl. cʌle, fem. sg. cʌli. In Kashmiri the root is ʦʌl; but when we add the velar ending the vowel changes to o, and *he fled* is ʦolw; the palatal ending for the masc. pl. produces two other changes; the vowel becomes ɜ, and the l becomes a palatal l; so *they went* is ʦɜly; when the centralized ending is added the vowel theoretically becomes ə, and the consonant becomes ɟ; we then get ʦəɟ, which actually, however, is pronounced ʦɜɟ. It is possible to maintain that phonetically we are not concerned with these changes, for we can consider them phonetically after the change has been made, and need not worry about the change itself. This is a short-sighted view. To get a thorough grasp of the pronunciation we must think not only of the resultant sounds but of the processes by which they are developed.

It may be asked whether these special consonantal forms are numerous. Nouns and adjectives (including past participles) are subject to changes of gender and number. Of these more than half have the peculiar consonants which we are discussing.

Finally, apart from palatalized consonants, Kashmiri possesses a palatal consonant, ɲ. One is almost inclined to add ʎ (palatal l), but words never have ʎ running all through their different forms. They may have l, changed in some parts of the declension or conjugation to ʎ; whereas ɲ as an independent sound may go through all the parts of a word. We therefore get some words with n changed in parts to ɲ, and others with ɲ all through.

43. Mr A. C. Sen (Northampton, U.S.A.): *An experimental study of Bengali occlusives.*

I shall present the results of a detailed study of the Bengali occlusives, including both the aspirated and non-aspirated sounds. The study was conducted by Dr C. V. Hudgins and myself in the phonetics laboratory of The Clarke School for the Deaf at Northampton, Massachusetts.

Kymographic records of all the occlusives were made under the following conditions of utterance:

1. Syllables containing occlusives were repeated at slow rates.
2. Aspirated and non-aspirated consonants were alternated in syllables with the same degree of intensity, as nearly as possible.

3. Single syllables were repeated at increasing rates of speed from very slow up to maximum rates.
4. Syllables containing aspirated and non-aspirated consonants were grouped into rhythmic units of two to five syllables.
5. Phrases containing aspirated and non-aspirated consonants were repeated with these consonants used as releasing, arresting, median and abutting consonants.

In all the nonsense syllables the same vowel was used (indicated in the figures by a).

Tracings were obtained of the following aspects of the speech mechanism: Tracings of the buccal pressure during the consonant occlusion; voice vibrations and air pressure just outside the mouth; tracings of the laryngeal vibrations; the lip stroke for the labials; pressure and voice from the nose; vertical movements of the larynx; tension of the muscles of the pharyngeal walls; breathing movements for the phrase; syllable pulses from the chest muscles.

The data were obtained from a single subject, a native of Calcutta, whose speech may be considered as typical.

The results show that there are certain fundamental differences in the mechanism of articulation of the aspirated and non-aspirated occlusives. These differences tend to become reduced, but they persist under various conditions of utterance. This is proposed by the author as valid evidence for the statement that the aspirated occlusives are distinct phonemes, and may be considered as single sounds.

Results

The aspiration of the consonants is clearly shown in the tracings of the air pressure just outside the mouth. The average length of this aspiration for all the sounds studied is 0·08 second. There are no observable differences in length for any of the individual sounds when spoken at identical rates.

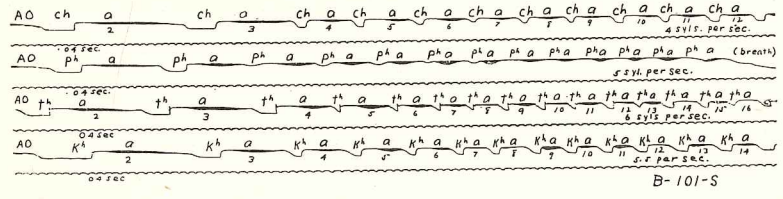

Fig. 1. Tracings of air pressure just outside the mouth for the syllables **cha**, **pha**, **tha** and **kha** spoken at an increasing rate of utterance. Time is recorded in 0·04 second.

Fig. 1 shows tracings of the four consonants **ch**, **ph**, **th**, and **kh**, in syllables spoken at an increasing rate of utterance from slow to maximum speed. The aspiratory phase of the consonants is visible in all the syllables during the slow rates but gradually decreases in length as the rate is increased, but seldom disappears.

It will be noted that the consonant **ph** behaves differently from the others as the rate is increased. At moderate rates the occlusion is