

# Phonetic fieldwork

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## ABSTRACT

Phonetic fieldwork, in the broadest sense, is the observation of people talking. Generally the observations are based on the phonological framework of the language. As a language is a property of a group of individuals, fieldwork studies have to include an account of the kind of variation permitted. Some kinds of variation cannot be summed up in terms of IPA symbols and fieldwork now includes a number of instrumental techniques and computer analyses.

## 1. INTRODUCTION

Anyone making observations of someone speaking is doing phonetic fieldwork.

“If you want to describe how people talk, you have to record some data and then analyze it. This is true whether you are investigating the variant pronunciations of street names in Los Angeles for a speech recognition company, or working as a missionary translating the Bible into a little known tongue. The basic techniques are the same irrespective of whether you are going into the wilds of the Brazilian rain forest to record the sounds of Banawa, or into the streets of a big city to find out how the home boys talk.” [1]

Fieldwork observations may lead to a description of a language, a dialect, an accent, or even just a particular speaker, but the principles involved in making a description of a child in speech therapy, a little known language, an accent of a familiar language, or a voice identification case, are all very similar. It is all phonetic fieldwork.

## 2. PHONOLOGY AND PHONETICS

We must, however, begin by noting that although there is much in common in all fieldwork activities, there is a fundamental difference between describing a language and giving a description of the speech of a particular person. A language has a phonological structure shared by a group of people; but an individual's speech has an unknown structure and may include many details that are idiosyncratic and do not fit into a description of the language as a whole. There are thus two distinct types of

phonetic description. One in which the business of phonetics is seen to be a matter of accounting for phonological (phonemic) differences, and one that has traditionally been called an impressionistic phonetic description.

This split into two types of description of speech sounds has been challenged recently in several important papers. Lindblom [2, 3] has made a good case for ‘emergent phonology’, the notion that phonological categories emerge from the data. In his view phoneticians should not start by trying to describe the physical phonetic manifestations of phonemes. They should be more concerned with describing the physical events that occur when people speak without reference to any pre-supposed phonological categories. Given a good phonetic account of the data, the formal description should be deduced from the data. As Lindblom puts it when discussing language acquisition: “Phonological structure must not prematurely be assumed to be genetically pre-specified. Rather it should be deduced from the child's experience and minimal assumptions about ‘initial knowledge’.” [2] In the technical sense of the term, it should be derived as emergent behavior.” He suggests that: “the doctrine of ‘form first, then substance’ must be rejected and replaced by another paradigm.”

A challenge along much the same lines comes from those phonologists working with Optimality Theory who argue for a phonetically driven phonology. In this view, phonologies are regarded as adaptive systems shaped by constraints. Hayes [4] calls the process of forming constraints *inductive grounding*: the term “grounded” describes constraints that have a phonetic basis. “Inductive” means that the constraints are learned by processing input data. As Hayes puts it: “...*inductive grounding* permits the language learner to access the knowledge gained from experience in articulation and perception, and form from it the appropriate set of formal phonological constraints.” This functionalist approach to phonology has much to recommend itself to phoneticians, but, as with Lindblom's approach, it does not provide a practical way to go about the business of sitting under a tree in Africa and trying to elicit information that will lead to the description of a language. It may be good enough for children, but (alas) not for linguistic fieldworkers.

Any phonological approach to fieldwork leads inevitably to a chicken and egg problem. Describing the phonetic

properties of the phonological contrasts requires that the phonology be known; but knowing the phonology implies that the phonetic distinctions have been observed. In practice it usually all works out all right. Fortunately, the phonetic distinctions need not be completely understood before the phonological differences are noted. As the work of Lindblom, Hayes and others suggests, it is important not to presume that the phonological structure of the language being investigated is known. But every fieldworker has had the experience when it becomes apparent that there is a contrast where none was expected. The speaker of the language comments on the fieldworker's attempts to repeat what is being said by saying something like "That doesn't mean x, it's the word for y". Eureka! A new minimal pair has been found. The fieldworker has deduced a distinction from the speaker's behavior.

The opposite, the discovery of the lack of a contrast, may be more difficult to recognize, because the speaker may sincerely believe that two words are different when they are not. Some speakers of English believe that they make a difference between *flower* and *flour*, and between *pier* and *peer*, just because there is a difference in spelling. Literacy can be a great problem for a fieldworker, especially in a country like India, where the learned have been literate for thousands of years.

### 3. NEW ASPECTS OF FIELDWORK

The way we go about describing the phonetic properties of phonological contrasts has altered in many ways over the last few decades. The biggest change in our approach to linguistic phonetic fieldwork is in our concept of what it means to describe a language. We used to be content with a one on one approach. A linguist would sit down with a language consultant, take out a notebook and start making phonetic transcriptions. There is now more emphasis on the notion that a language is a property of a group of individuals. We need to work with a number of speakers, determine how representative their speech is of the language as a whole, and what kind of variation is permitted within the language of that particular group, a topic that Paul Foulkes will be discussing in this symposium.

The next most important change that has happened is that we realize that it is not enough to use our ears and make a good phonetic transcription. We need to make a permanent acoustic record of the data. This is not as straightforward as it might appear. We all know how to keep records on paper but we don't know how to store sounds. The situation keeps changing. We (well, our forefathers) used to use wax cylinders. They can still be played, but it takes a lot of effort. Even finding a way to play 78 rpm vinyl records is hard. Reel to reel tape recorders have almost vanished, and their brittle tapes have to be handled with care. Cassette recorders are still readily available, but one wonders for how long. Digital systems are great at the moment, but DAT tape machines appear to be headed for a

short life. CDs look like they are going to be around for some time, but who knows? Computer systems change very rapidly. Few of us can still use the punched tape or 5" floppy disks we made some years ago.

At the moment, probably the best procedure is to archive everything on CDs; but it is still important to keep good written records to support the audio. An acoustic record with no accompanying written documentation is almost worthless and seldom consulted, but a recording that is accompanied by detailed notes and a phonetic transcription is a valuable resource. A recording is a complement rather than a substitute for a transcription. There are numerous uncertainties about storing sounds, but writing has been around for many centuries, and print has been with us since at least 1455. We may lose the ability to play a particular recording, but if there is a transcription we will still have many facts about the original utterance, classified in terms of IPA symbols.

### 4. THE LIMITS OF TRANSCRIPTIONS

We should, however, be aware of the limitations of a description using symbols. The IPA is a powerful tool enabling phoneticians all over the world to communicate their findings to one another. But it can never provide a complete description of the differences between languages. As a simple example of the relation between an IPA transcription and the phonetic data, consider the problem of transcribing a particular individual producing the well known minimal set illustrating the four tones of Standard Chinese. A textbook account [5] of these tones using the IPA tone symbols is shown in figure 1.

| STANDARD CHINESE <b>ma</b> |             |                  |               |
|----------------------------|-------------|------------------|---------------|
| Chinese character          | Tone symbol | Tone description | English gloss |
| 媽                          | ˥           | High level       | 'mother'      |
| 麻                          | ˨˨˨         | High rising      | 'hemp'        |
| 馬                          | ˨˨˨˨˨       | Low falling      | 'horse'       |
| 罵                          | ˥˥˥         | High falling     | 'scold'       |

Figure 1. A textbook account of Chinese tones.

The IPA system of tone letters in the second column represents 5 pitch levels that can be numbered 1 to 5, with 5 being the highest. The tone symbols consist of a vertical stroke on the right, which can be considered to represent the speaker's pitch range, and a bar to the left, starting at one of the 5 pitch levels and ending on the vertical stroke at the same or a different level. Thus the tones can be expressed in terms of the five numbers by showing the beginning and end points of each tone, and any peaks or

valleys in between. The first tone symbol in figure 1 corresponds to the values 55, a transcription that corresponds to the speaker beginning and ending the tone on the highest level. The second symbol denotes a movement from pitch level 3 to 5, the third from 2 down to level 1 (the pitch often rises again, but this is not shown in this symbol), and the fourth can be written as 51, a fall from the highest to the lowest level. This is a traditional account of these Chinese tones as said on these words, spoken in isolation.

Now consider a particular speaker of the words in figure 1, a recording of whom is available at [5]. The  $F_0$  records (pitch tracks) of these words are shown in figure 2. Note to begin with that tone 4 starts on a distinctly higher pitch than tone 1.

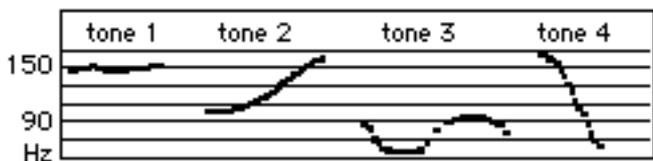


Figure 2.  $F_0$  (Pitch) records for the Chinese tones.

We might consider this speaker's pitch level 5 to be anything above 160 Hz. Given this, level 4 might be 140 to 160 Hz, level 3 to be 110 to 139 Hz, level 2 80 to 109 Hz, and level 1 anything below 80 Hz. Using these values it would be more accurate to transcribe these particular words, on this particular occasion, with symbols showing that the first tone had levels 44, the second 24, the third 212, and the fourth 51.

Attempting to translate acoustic data into categorical numbers in this way is not an appropriate method of arriving at an IPA transcription. Furthermore, we should

said that the four Chinese tones could be described as being (for this speaker, on this occasion): (1) high, (2) mid high (or high rising), mid extra-low mid, and extra high falling. Other similar descriptions would also be possible.

There is no one correct answer to this problem. A transcription is a description in terms of symbols for discrete categories, and there is no definitive way in which these categories can be related to phonetic measurements. The way to produce a more precise account of the phonetic realization of tone is to present pitch curves, something we can now do with our computers in fieldwork situations.

The same point can be made with respect to many other phonetic characteristics. Symbols for vowel qualities cannot be unambiguously assigned as a result of an acoustic analysis of the formant frequencies. The phonetic details of vowel qualities can be shown by means of plots of formant charts, but there is no way that such plots can be unambiguously related to the symbols on an IPA vowel chart. Languages also differ considerably in the duration of the aspiration in voiceless stops [6]. We cannot represent this in terms of symbols. It is no longer appropriate to say simply that a language or dialect has sounds that can be represented by the three categories, aspirated, voiceless unaspirated, and voiced. A full description will state the mean VOT of each type of stop. This can be achieved only by analyzing acoustic records, so that we can report all the details that are not conveyed by even the narrowest phonetic transcription.

## 5. EXPERIMENTAL PHONETICS IN THE FIELD

In addition to acoustic data, there should also be data showing how the sounds are made. Even the best trained ears cannot tell exactly where the tongue touches the roof of the mouth, or the precise ratio of nasal to oral airflow in a nasalized vowel. Some of the physiological and acoustic analysis techniques that are currently available will be discussed by Matthew Gordon in his paper in this session.

The most recent change in our fieldwork techniques is in the amount of analysis that can now be done while still in the field. Laptop computers can be used not only for recording acoustic and physiological data, but also for carrying out sophisticated analyses. We can thus correct our first false impressions. For example, when first listening to Angami, a Tibeto-Burman language spoken in India, it seems as if the voiceless nasals are followed by an epenthetic voiceless stop, so that /aŋe/ 'He blows his nose' sounds like [aŋt<sup>h</sup>e]. But, as shown by the oral and nasal flow records in figure 3, there is no oral stop. There is a voiceless nasal with a few initial periods of voicing during the interval marked (1). This nasal then has an oral release (without there ever having been a complete stop closure) at the time marked (2). The interval marked (3) has both nasal and oral airflow, making this sound most

### TONES AND WORD ACCENTS

| LEVEL           |            | CONTOUR |                |
|-----------------|------------|---------|----------------|
| e <sub>or</sub> | Extra high | e       | Rising         |
| e'              | High       | ê      | Falling        |
| ē              | Mid        | e       | High rising    |
| e`              | Low        | e       | Low rising     |
| e%`             | Extra low  | e       | Rising-falling |
| ↓               | Downstep   | ↗       | Global rise    |
| ↑               | Upstep     | ↘       | Global fall    |

note that the situation is made more complicated by the fact that the IPA chart provides not only the tone letters used in figure 1 but also, as alternative symbols, a set of accents, plus a set of terms that are not easily applied to this data, as shown by the excerpt from the IPA chart below.

Using terms such as those in these columns, it might be

appropriately called a voiceless aspirated alveolar nasal. (For further discussion of this sound see [7, 8]).

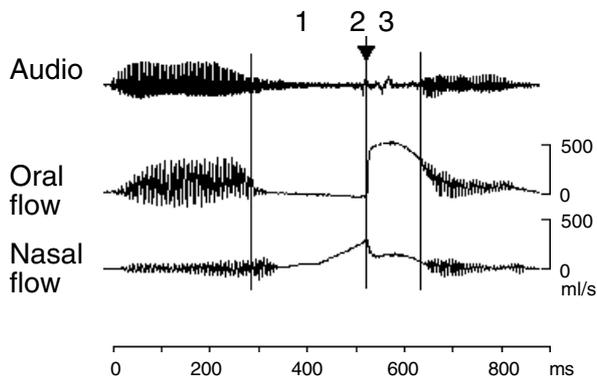


Figure 3. A voiceless aspirated alveolar nasal in Angami.

The possibility of being able to check our analyses and find mistakes while still in the field has raised the level of fieldwork observations. Similarly the possibility of being able to use radio telephones, e-mail and web-based communications whilst in remote locations has increased what can be done. We can send files home for additional analysis, look up bibliographies and do a considerable amount of research while still in the field in the traditional sense. We can get data back and have colleagues check and suggest hypotheses, making our research much more collegial. There are very few cases in which it is still true that being in the field necessitates being off on one's own.

We can also use these new communication techniques to investigate the speech of people in distant locations without having to travel. Of course, as John Wells will mention in his presentation, research through the mail has always been possible. Now the web offers similar possibilities and more. Sounds can be uploaded so that speech perception experiments can be carried out. Experiments of this kind are useful although they are hampered by having many uncontrollable variables. The listening conditions may vary from cheap headphones to high quality loudspeakers. The respondents may be alone or in a noisy room. They may be paying full attention or eating lunch and chatting at the same time. But if the tests include good consistency checks, and request respondents to state who they are and how they are listening, then, assuming honesty in the respondents, some worthwhile results may be obtained.

## 6. CONCLUDING COMMENTS

Finally, we must return to the discussion of the two types of fieldwork mentioned at the beginning of this paper, phonologically based descriptions as opposed to purely phonetic, impressionistic, descriptions. Most of this paper has discussed the first of these two types. This is largely because there is really little that can be said about impressionistic fieldwork, the study of the speech of an individual without reference to a phonological system.

Such an approach is inevitable when dealing with anyone learning a language, who has no known phonological system. The investigator may have no information on what system of contrasts the speaker is using. All that can be done is to make the best possible acoustic record and a detailed impressionistic transcription. Similar remarks apply when dealing with an unknown speaker in a voice identification case, or any speaker with an unknown background being heard for the first time.

A concluding note: fieldworkers should always remember the most important principle of fieldwork: publish a complete account of the work, even if it is only on a local web site. Private knowledge does the world no good. In addition, data should be stored in a way such that it can be found and used by others. Even if no one else wants to look at it, the fieldworker should be able to go back to it in future years. If it has not been properly stored as interpretable records, it will be difficult to remember what happened. In addition, the language consultants or speakers should be kept informed as to how it all turned out. They should be sent a copy of the report. This is not just a matter of being polite, although it is also that. It ensures that later investigators will get a good reception. Finding out about languages is fun. We enjoy doing it, so we should make sure that others share in our delight.

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