

VOICE QUALITY:

A SUGGESTED FRAMEWORK FOR DESCRIPTION AND SOME OBSERVATIONS

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INTRODUCTION

In the phonological description of languages very little attention to date has been given to what is designated here as 'voice quality'. References are found to contrastive voice qualities used by speakers

of a language to signal certain emotions or attitudes, but comparatively little has been done on attempting to describe the normal voice quality or range of qualities used by a dialectal community, and how this contrasts with that of other dialectal communities. Reasons are not hard to find: the phonologist is interested in the contrastive phonological units (both segmental and prosodic) which make up the signalling system of the language, and tends to adjust to and ignore the non-contrastive phonological medium of the language. Voice quality has not always been easy to define closely: from auditory analysis voices have been classed as 'husky', 'nasal', 'penetrating', etc., but opinions have sometimes differed on the mechanisms responsible for producing these qualities. But of recent years research by phonologists, speech therapists and others has enabled us to understand much more clearly how the sounds are made. The sonagraph and other instruments have also been developed, allowing instrumental records of the acoustic phenomena to be obtained. Development of such instruments has now reached a stage where they can be used to identify the voice of an individual even on the telephone. Hence it is now possible to compare mechanics of production, acoustic analysis and auditory impression, and thus to define voice quality closely.

Despite the neglect of this subject it is the contention of this paper that phonologists should concern themselves with it. As defined below, description of voice quality of a dialect¹ includes specification of the optimum configuration of the vocal apparatus for ease of articulation of the sounds in a given dialect. The recognition of this may often help the phonetician in analysing a (to him) unusual sound, or in realising why sounds are made in a certain way in that language. It may also reduce some cumbersome detail in a narrow phonetic transcription of the language, in that features which apply over a stretch of speech need only be marked once for that stretch. It is also necessary for a complete description of the phonological medium used for a given language to note not only phonological *contrasts* but also phonological *sames*, i.e., phonological items that remain constant for a large portion of the speech. These latter vary from language to language, from dialect to dialect, and a person concerned with learning to speak a language with native ability should be able to mimic accurately the voice quality of a new language (as well as the phonemes, intonation, and other features) if he is ever to cease to be branded as a foreigner by his speech. Here it should be noted that Australian Aborigines seem very conscious of voice quality.

Different linguists have been criticised as having a voice 'too tender', or 'not heavy enough', or 'needing to be more light', etc. The linguist who is unaware of voice quality is often at a loss to interpret these comments.

Some people have a natural aptitude for mimicking the voice quality of another person, dialect, or language. Many others can recognise different dialects (or the original language of a speaker) from clues of which voice quality is one. This quality enables us to recognise the nationality of a voice, or the voice of a particular person, even when listening conditions are such that individual words cannot be distinguished. Within Australia, for example, many Australians, not professional linguists, maintain their ability to pick the place of origin of many of their fellow countrymen, and can do so with fair accuracy. The use of occasional distinctive words or distinctive pronunciation of certain words is one clue which has been well recognised, but I feel this is overrated as a means of recognition and cannot entirely account for recognition (the specified words do not always occur in the first few sentences of conversation). From my own observation I would suggest that a number of small differences contribute to recognition: some facial shapes are found in one area and not another, sometimes with differences in colouring; intonation differs slightly; speed of utterance varies; certain constructions and words are more frequently used in one area than another; voice qualities differ. The present paper is concerned only with voice quality, and most observations will be made with reference to Australian English speakers native to Sydney and Brisbane, and to Australian Aborigines.

FRAMEWORK FOR DESCRIPTION

Voice quality will be defined as the perceived common acoustic feature within any subset of the phonological inventory of a language. We can speak of the voice quality of an individual, of a dialect group, or of a subset of sounds or utterances within a language. This quality provides as it were a phonological medium for the contrastive phonemes, intonation, etc. Contrastive voice qualities are used in many languages to signal such things as emotions and attitudes; however even within these contrastive qualities there is often some common quality which distinguishes one dialect group from another.

Speech sounds are made with the vocal apparatus, and progress has been made in the correlation of perceived voice quality with the configurations, tensions and movements of the parts of the vocal

apparatus. To a certain extent these may be determined by the size and build, health, sex, etc., of the individual or group, but to an extent greater than most people realise it seems voice quality is learnt rather than inherent, even when some factors may predispose towards a particular voice quality. It is highly probable that much of the characteristic facial expression of different races or dialect groups is learnt. For example, some people observe that Queenslanders smile more readily than southerners, and in speech many of them have lips more spread than the latter.

For convenience here the articulatory factors influencing voice quality are treated under two divisions, phonatory setting and resonant setting. Each individual phone in a language has its own phonatory and resonant settings, but when the setting for a language, dialect, or subset of sounds or utterances within a language or dialect is referred to in this paper, it is the setting common to all the sounds under consideration. For example, one could refer to the setting distinguishing all utterances in language A from all utterances in language B, to the setting for all angry utterances in a language, or to the setting for all voiceless vocoids in a language such as Cheyenne.

Phonatory setting is defined as that configuration of the larynx responsible for generating a sound. Whether the configuration produces a regular tone or a random noise matters not; it is still a phonatory setting. (This definition is roughly equivalent to that given by Catford.)

Resonant setting is defined as that configuration of the resonant chambers and articulators responsible for producing a particular resonance.

Some resonant settings are directly linked with what Honikman calls 'articulatory settings'. She defines the articulatory setting as "the gross oral posture and mechanics, both external and internal, requisite as a framework for the comfortable, economic, and fluent merging and integrating of the isolated sounds into that harmonious, cognizable whole which constitutes the established pronunciation of a language".² Some configurations and movements of the vocal apparatus are more obviously related to fluent merging of the isolated sounds than others; if required a further distinction within resonant settings can be made between articulatory setting in Honikman's sense, and modifying setting. This latter, modifying setting, would include degree of tension of palate and degree of opening of the nasopharynx (both affecting perceived nasality), degree of tension of the fauces (faucalisation

gives a penetrating, harsh quality to the voice, sometimes dubbed a nasal twang), and position of larynx and tongue root (which affect the frequency of the vowel formant bands, and therefore the 'thinness' or 'heaviness' of the voice). The distinction between articulatory setting and modifying setting will sometimes be made below, but it can create problems of how to apportion settings among these two. One needs to be aware that what may be perceived acoustically as a modification is often traceable to an articulatory setting in Honikman's sense (see discussion below on nasality). One could also discuss whether the inventory of contrastive sounds in the language was responsible for the articulatory setting, or whether the articulatory setting was responsible for many of the sounds. This was hinted at by Honikman, when she alluded to the contribution that a study of this phenomenon could add to "our comprehension of the past and future developments of particular languages."³

Resonant setting would also include setting of parts of the body other than the vocal apparatus. This area is relatively unstudied and such settings are believed to have only a minor influence on voice quality. However chest resonance is considered to contribute something to the quality of a bass voice, especially in singing; it also has been noted that 'clavicular' (upper thoracic) breathing can be injurious to the voice, and that certain breathing techniques taught to singers do produce a voice of increased resonance, though it is not yet clear why.⁴ Bodily posture varies somewhat from people to people, so this may have some influence on the voice quality.

PHONATORY SETTINGS

Catford's article has much valuable information on the subject of phonatory settings, and he points out that different phonatory settings are taken as normal in different languages. I noticed phonation of very breathy quality (coupled with a much wider lip and jaw setting than is typical elsewhere in Australia) in one student at the Summer Institute of Linguistics recently, and have since then come across similar phonation in other speakers from her home area (near Gippsland, Vic.). It appears that no-one has yet done much study of phonation or resonant settings within Australia, or considered them to be linked with area or dialect.

I have also wondered at times whether there may not be some evidence for speaking pitch differences correlated with dialect within certain areas or groups in Australia. Catford mentions pitch differences briefly. The deep voices of some Japanese men, and the high-

pitched voices of many Indian men is sometimes commented on by Australians. Although the size and shape of the larynx to a certain extent determines the pitch of the voice, the talking (and singing) pitch range is largely learnt. Greene mentions that it appears that the infant at approximately 9 months has a much larger vocal pitch range than later, and the loss of range and the choice of the speaking pitch is done under the influence of the environment. The same applies for the singing range also. "The singing range is largely determined by conditioning of the ear and muscular control to the conventional musical pattern. Wolfsohn was able to train his pupils to break away from convention and recover a range of 6 octaves similar to that of the untrained infant."⁵ The Indian man speaking with a high-pitched voice is possibly using the thin register of the vocal folds (sometimes called the head register, see fig. 1), which register would also contribute to the different quality of his voice. Greene mentions an investigator (Moses) who found amongst children a pitch difference not correlated with length of vocal folds. He found a sex difference in vocal range developing between 4 and 5 years old, though there was no difference in length of the vocal folds. He considered the adaptation to be due to the child's awareness of his sex and some of its implications. Greene adds that "this view is not generally accepted but has quite probably been insufficiently explored and requires scientific investigation."⁶



a) thick or chest register

b) thin or head register

Fig. 1. Vertical cross section of vocal folds during voicing, open phase

RESONANT SETTINGS

While speaking of phonation types, Catford mentions modification to the resonance by the position of the larynx (raised or lowered). This would be a resonant setting, rather than a phonatory setting by the definition in this paper. Catford writes:⁷ "As is well known, larynx-raising is a common accompaniment of high pitch (presumably

because the larynx is braced up to the hyoid bone to withstand the strong pull of the crico-thyroid muscle acting to stretch the vocal folds), and larynx lowering often accompanies the production of (long) voiced stops, serving in this case to increase the volume of the supraglottal cavity, so preventing the supraglottal pressure from increasing to the point where the necessary pressure-drop across the glottis is abolished." "It is, however, easy to train oneself to raise or lower the larynx, and vertical larynx displacement is a modification which can be applied to most types of phonation. With voiced vocoids the main acoustic effect of larynx raising or lowering is, as one might expect, the raising or lowering of the first formant."

I have found resonant settings easier to be aware of than phonatory settings. In fact my mode of analysis has tended to be to endeavour to mimic the foreign voice quality, working back from the lip and jaw setting (which one can easily observe, and often finds oneself unconsciously reflecting), back through the vocal tract to the larynx, adjusting settings in this sequence until I have seen, felt and heard an approximation to the foreign settings to have been obtained. There is less mistaking a correct setting if it is visible to the eye, and often when the shape of mouth, etc. is reproduced, some non-visible internal setting correlated with it is also put right. This is so because the various parts of the vocal apparatus are more intimately tied together than we often realise.

FACIAL EXPRESSIONS AND ARTICULATORY SETTINGS

Honikman has drawn attention to the similar expression of people of one language group. "Watching the speakers in, say, French, Russian, and English films, it is interesting to note (a) the difference between these in 'look' about the mouth and jaw, and (b) the similarity of 'lip-jaw look' of the individual speakers in any one of them."⁸ Even when obvious similarities of facial build within one dialect group is allowed for Honikman's observation is still valid, and she further states: "In French utterance the tongue setting and rather frequent lowering of the jaw allows the tongue to be visible, whereas in English, the jaw-movement is so slight and the internal setting such, that the tongue is hardly ever visible during utterance."⁹

Languages may have identical or similar phoneme inventories, yet differ in some articulatory setting. I noticed this in three relatively closely related languages in Central Queensland. As these languages are dying out, I could only compare individual speakers. All these

languages had on the whole a wider jaw position and less tense lips than Australian English. One language, Gureng Gureng,¹⁰ from the Burnett River area, had spread lips, and all vowels unrounded. Inland from this language were another two languages, Bidjara and Gunggari,¹⁰ whose speakers had spread lips (though possibly not as widely spread as in Gureng Gureng), with very obvious rounding for the vowel /u/. North of these is another language, Biria,¹⁰ in which the lips were rather rounded for all sounds, with no extra rounding for the high back vowel.

ARTICULATORY SETTINGS IN AUSTRALIAN ENGLISH

Articulatory settings also seem to vary in Australian English according to area. While my observations have been casual, observing individual speakers in normal environment, it seems true to say that at least a large proportion of people from Brisbane and further west have unrounded and spread lips for all of their speech, particularly among the men. Some women round the lips for some of the back vowels, but some do not. This contrasts with many Sydney people who have a less spread lip position with slight rounding of the lips. Among older Sydney and Brisbane people the difference may be more marked, and different wrinkle patterns develop as a result. Among Sydney people a little extra rounding may occur for the back vowels, and both Brisbane and Sydney dialects round the lips slightly for /w/. My casual observations indicate that the slightly rounded lip position is common among people from Newcastle to Tasmania and across to Adelaide. The wider lip and jaw position in one area of Victoria was noted above. Another lip setting seems to occur in places north of Brisbane, such as Rockhampton to Cairns, among some women at least. The lips are not so spread, the opening is unrounded, and the lips are held more tensed, tension increasing for the back vowels. It is emphasized that these are casual observations, but they have been noted by other observers also, and there would seem scope for a systematic study of the subject.

This contrast in lip position between many Brisbane and Sydney speakers can account for two observations that are made on the difference in sound between these dialects. These are that there is a 'lighter', 'more Australian' quality about Queensland voices, and there is a more perceptible nasal quality in Queensland voices.¹¹ This 'lighter' quality I presume (without as yet any instrumentally checked data) to be due to a greater proportion of higher harmonics in the speaking voice. Rounded lips reduce the amplitude of higher

frequencies selectively (as one can easily test by articulating the same phone with rounded and unrounded lips, especially when whispering), so this effect seems well correlated with the lip position. Regarding nasal quality, Greene points out that in most English dialects there is some nasal escape of air, except when stops are articulated. Air in the nasal cavity will resonate even when the nasal passage is closed, due to sound waves transmitted through the soft palate. Resonance of nasal quality is produced not only when the velic is well opened, but also when there is present pharyngeal or faucal constriction. And according to Greene, the characteristic nasal resonance is due as much to the bottling of the sound waves in the oral (and pharyngeal) cavity when oral escape is stopped or restricted as to escape of air through the nose. Cleft palate patients who cannot prevent nasal escape of air can learn to speak in such a way that nasality is not apparent, or is not much above the normal amount. This is done by opening the mouth much wider in speaking, and relaxing tension in the soft palate, faucal pillars, etc. Conversely then, a narrow mouth opening presumably increases the perceived nasality of speech in persons with normally formed vocal apparatus. Hence the perceived nasality of Queensland speech. Curiously some Brisbane people accuse Sydney people of nasality. It appears to me that the 'nasality' of Sydney people's speech is due to a greater degree of faucal tension. As both the cause and the timbre of 'nasality' differs, it can be seen how each can accuse the other of 'nasal speech'. Faucalisation present in the speech of many Americans, despite the wider mouth opening (see next paragraph), accounts for the peculiar carrying 'nasal twang' of their speech.

It is doubtful whether the difference in lip position between Brisbane and Sydney speakers referred to is correlated with differing phoneme inventories or distributions in the dialects,¹² but in many languages lip position, and with it jaw position, is to an extent correlated with the phonemic inventory of the language. In most varieties of Australian English the jaws are loosely held in an almost closed position. However the jaws, and with them the lips, are wider apart in many varieties of American English. The strongly retroflexed /r/ of American English¹³ requires for ease of articulation a wider jaw setting, so it is not surprising that this is a feature of American English.¹⁴

Honikman comments that "the articulating organs require to be so placed that all the actions required of them are easy and comfortable and able smoothly to link and merge with their neighbours."⁹ "It is

because the student is inclined to interpret the articulations analysed in textbooks, not as events in a moving continuum but as a manifold of detached articulations, that he so often fails to co-ordinate them satisfactorily."⁸ "The internal articulatory setting of a language is determined, to a great extent, by the most frequently occurring sounds and sound combinations in that language. Since it is the articulation for consonants that interrupts or impedes the free flow of the air stream through the mouth, the setting required for the most frequent consonants has an important bearing on the articulatory setting as a whole - no less important than that required for the most frequent vowels."⁹ In English, as she points out, the most frequent consonants are among the alveolars, and the close and half close front vowels are reasonably common. Hence the setting of the tongue. "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; the lateral rims of the tongue very seldom entirely leave this part of the roof of the mouth, whereas the tip constantly (or some other part of the dorsum, occasionally) moves up and down, periodically touching the central part of the roof, but generally not for very long at a time, before it comes away. Thus, one might regard the tethered part - in this case, the lateral contact - as the *anchorage* and the untethered part as the *free or operative part* of the tongue-setting."¹⁵ Her description of the tongue setting seems to me to apply to most Australian English also. These settings are learnt early in life, and are then usually the 'rest positions' taken up by the jaws, lips, tongue, etc., when not speaking.

ARTICULATORY SETTINGS IN ABORIGINAL LANGUAGES

Amongst most speakers of Australian Aboriginal languages one is conscious of a wider mouth setting and a conspicuous tongue. For Alawa,¹⁶ in the Northern Territory, the following is noted: the jaw and lips have a wider opening than in Australian English, and the lips are more lax; the lips are unrounded (except for /w/); the tongue is not tapered as in English, but somewhat retracted and the tip rounded; the rest position of the tongue is with the top convex to the roof of the mouth and with the tip behind the bottom teeth (see fig. 2). The tongue tip remains behind the bottom teeth except when alveolar or retroflexed points of articulation require it elsewhere. The palatal series of consonants are therefore formed with the tongue in the alveo-dental position, except where such a consonant is contiguous to an

alveolar or retroflexed consonant when the alveopalatal position occurs.

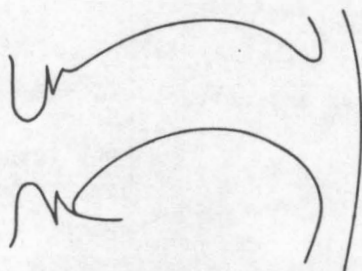


Fig.2. Rest position of tongue in Alawa

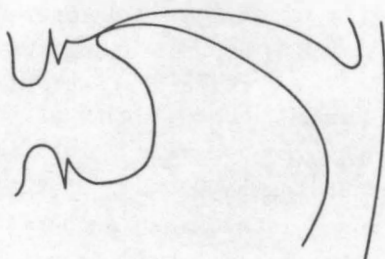


Fig.3. Alveolar articulation in Alawa



Fig.4. Retroflexed articulation in Alawa

This rest position of the tongue accounts for a problem in Alawa, that of the alveolar and retroflexed sounds. A phonemic contrast can be shown to exist between alveolars and retroflexed sounds, yet in many cases the alveolars, to the English ear, have a 'retroflexed' quality to them, and it is difficult, by either sight or sound, to distinguish between them. Figures 3 and 4 show why this is so.

In forming the alveolar, the underside of the tongue can be seen to be concave to the floor of the mouth, from which one can assume that the top of the tongue tends to be convex. It has been shown¹⁷ that the English /r/, the retroflexed continuant, is produced by different speakers and in different dialects in different ways. Some retroflex the tongue tip, others bunch and retract the tongue slightly. The 'retroflexed' quality is produced by this humping of part of the tongue, however it is done, in the upper part of the oral cavity. The shape of the tongue as it approached articulation for alveolar consonants in Alawa would give this humping and impart the retroflexed quality noticed in vowels preceding the alveolars. In Australian English, with the very slightly concave top of the tongue during alveolar articulation there would be none of this retroflexed quality.

PITCH AND NASALITY

Other factors influence the quality of the voice. It has been mentioned that there is nasal escape in much of normal English speech. Nasality is more apparent in deeper male voices than in the higher pitched female voices according to Greene. I noticed less nasality among female speakers from Brisbane than among male. This may in part be due to the different lip opening, but the pitch probably also plays a part. Mitchell and Delbridge noted "some degree of hypernasality" among 23% of boys and only 7% of girls in their survey of speech of Australian adolescents. Nasality was concentrated fairly heavily in the Broad Australian speakers also.¹⁸

FAUCALISATION

Faucal constriction seems to be a feature of much American English, some Australian English, and of Australian Aboriginal speakers, but the over-all effect is not quite similar, no doubt due in part to different tongue positions. Some of the differences may also be in phonation type: I was intrigued, during a trip to an Aboriginal settlement not far from Brisbane, to notice a marked similarity in voice quality between Aboriginals there and an American who had a voice affected and made permanently somewhat husky due to an infection in his youth. His voice stood out as distinctive both among Americans and Australians, but blended perfectly with the Aboriginal he was speaking with. While there is something of the voice quality which sets off Aboriginal voices from other Australian voices, yet there are discernible differences of quality from tribe

to tribe. The Anindilyaugwa of Groote Eylandt have a different quality to the Roper River people, possibly a richer and less faucalised quality. A linguist who recently spent some months in New Guinea also commented how she had noticed different voice qualities distinctive to different tribes there.

ENVIRONMENTAL FACTORS

As information is accumulated on voice qualities it would be interesting to investigate how often it is tied or partly caused by physical or environmental factors. Greene mentions that the dialect spoken in Liverpool, England, has an environmental cause:¹⁹ "Chronic catarrh may apparently also be induced by damp climatic conditions, the population in certain areas being more afflicted with this troublesome complaint than others. In Liverpool, for instance, chronic catarrh is so prevalent that the most pronounced characteristic of the local dialect is its reduced nasality. Individuals speak as if they suffer from a severe cold in the head which in many cases is true. The dysphonia, however, is mainly imitative." The voice quality of the Roper River people may be effortlessly approximated while suffering from a cold and sore throat, which makes one suspect similar factors are at work.

OTHER PHONOLOGICAL FEATURES

As well as voice quality as defined here, another feature of the phonological medium, namely rate of utterance (or apparent rate) has sometimes been alleged to be associated with different environments. Melbournians often appear to speak rapidly, some Queensland people slowly. Rate of utterance, timing and stress are other fascinating features which distinguish languages and dialects, as much as does voice quality, phonemes and their distribution, and intonation, but they are outside the scope of this article.

THE CHILD'S ACQUISITION OF VOICE QUALITY

A question which could be investigated is at what age a child learns the characteristic voice qualities of his dialect community. It is often noticed that when a foreign speaker learns the phones of a new language reasonably well, and almost masters the grammatical patterns, he still very often retains his own intonation, rhythm, and stress patterns. From my own observations of many fluent speakers of foreign languages, even when they have mastered the above, the quality

of voice still very frequently betrays the original language of the speaker. Since becoming aware of this phenomenon, I no longer think far fetched the ability of Shaw's Professor Higgins to pick the place of origin and the linguistic history of individuals. It would seem that the individual is slowest to change his voice quality, less slow to change his intonation, and fastest to change segmental phonemes (see footnote 12). It is comparatively well known that intonation patterns are mastered by a child earlier than segmental phonemes, or even the bulk of these. As voice quality seems yet more persistent it is possible that some of its features are learnt at an even earlier stage than intonation. The feature learnt soonest may well be facial expression, and articulatory settings arising from this. I had observed some time ago the facial expressions of two 18-month old children, not yet speaking much that was intelligible. The first, born in Brisbane and with parents and grandparents also from Brisbane, closed his lips in the spread, half-smiling position I had noticed in his home area. The second, whose parents and grandparents were from Sydney (he was actually born in Sweden and spent his first year there) closed his lips in a rounded position. It is possible that not all settings contributing to voice quality are learnt at this age - or at least are not produced at this age; in particular the larynx undergoes considerable growth and development between the age of 9 months and 5 years, and also children's and adults' voices differ acoustically. But confirmation that voice quality is learnt early comes from Greene, who quotes work by Piaget showing that children reflect both *facial expressions* and *vocal sounds* in their environments from an early age. "The ability to 'imitate' fluctuates; in its early stages starting at 2 weeks it is a reflex reflection, a facial movement or sound which Piaget, who has analysed the process minutely, calls 'contagion'. The imitative reflex responds to the speech the baby hears gradually condition his vocal play and by six months the intonations of his particular language environment are heard in his babbling."²⁰

CONCLUSION

The treatment here has been of necessity sketchy and tentative, but it seems that the recognition of voice quality as largely learnt and as correlated with dialect will prove useful and productive in the phonological study and description of languages, and that soon we should be able to specify the setting responsible for voice quality as much as one specifies manner and point of articulation for segmental phones. Study of voice quality may also help solve dilemmas such

as we have on Australian English, where a study of the segmental phones shows very little correlation of these with location, while it is still possible for many inside and outside Australia to pick the town or state of origin of an Australian.

N O T E S

1. For the purpose of this paper the term dialect can refer to a distinctive form of the language spoken by any communal group. The distinction may be obvious (as in having different phonemic inventory or very different allophones of phonemes); or it might be more subtle (as in having different voice quality, intonation, or speed), so that only the most observant or those most familiar with the dialects notice it. This paper is concerned with phonetic features, and only phonetic differences are under consideration when dialect or language is referred to, though there are usually concomitant grammatical and lexical differences.

2. Honikman, p.73.

3. Honikman, p.83.

4. Greene, p.19, 20.

5. Greene, p.74.

6. Greene, p.73.

7. Catford, p.34.

8. Honikman, p.74.

9. Honikman, p.75

10. In Capell, Bidjara is listed under E.8, Biria under E.10, Gunggari under L.19 and Gureng Gureng under E.37.

11. The Queensland accent has also been described as more broad on the average, but I do not think this is attributable to voice quality, but to segmental vocoid glides. I was interested by a voice at one meeting which did not fit a pattern. I finally analysed it as vowels like a Queenslander but the voice of a Sydney person: questioning showed the person had grown up in Sydney, but had spent much of his working life in northern New South Wales and Queensland.

12. There are certain neutralisations of vowel phonemes occurring with some speakers of Australian English, and these seem to be correlated with area; an example is the loss of contrast between long and short 'o' before /lt/ for some speakers. It would be an interesting study to see if there is any reason tied to articulatory setting why such neutralisations should be distributed according to dialect. But the point being made is that the differences are slight.

13. Among some speakers of American English phones /t/, /d/, /n/, and /l/ occur in words spelt with 'rt', 'rd', 'rn' and 'rl' respectively.

14. An Australian teacher of the deaf commented to me that it has been found that Americans are easier to lipread than Australians, and among Australians women are easier to lipread than men. See the above comment on rounded vowels among Queensland women. This lip positioning may also be correlated with the general division of Australian English into 'broad', 'general' and 'cultivated', and the greater tendency for female speakers to congregate towards the 'cultivated' end, and male speakers towards the 'broad' end of the spectrum.

15. Honikman, p.76.

16. Found in Capell under N.1.

17. Heffner, p.141 ff.

18. Mitchell and Delbridge, *The Speech of Australian Adolescents*, p.61, 62. Mitchell and Delbridge also noticed appreciably less pervasive nasality - as opposed to nasality conditioned in certain vowels contiguous to nasals - in migrant children from non-British families. This would no doubt reflect the voice quality of their family's original language.

19. Greene, p.206.

20. Greene, p.211. This quotation only mentions specifically facial expressions and intonation, not voice quality as a whole.

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