The relationship between pharynx width and larynx height differs from the relationship between tongue height and pharynx width. We know from studies of other languages that do not have vowel harmony of the kind found in Akan that larynx height may vary with vowel quality (Ohala, 1973). But the manner of this co-variation is not altogether consistent. The root of the tongue is more forward for [i] and [u] than for [a], so one might predict that the larynx should be lower for [i] and [u] than for [a], following the pattern in the vowel harmony languages. This is sometimes the case, but by no means always. Ohala (1973) reviewed the literature on this topic, and he found two patterns: in the order from high to low larynx: [i a u] and [a i u]. Only the second pattern corresponds to the prediction. The existence of the first pattern shows that something other than tongue height or backness may influence the vertical position of the larynx.

Moreover, there are no intrinsic connections between the larynx and the tongue root that would necessitate the larynx to move vertically down, as the tongue moves horizontally forward. The reason underlying the strong correlation between pharynx width and larynx height must be something other than physiological necessity.

By combining the advanced tongue root with a lower larynx position and the retracted tongue root with a raised larynx, the speaker accomplishes a larger variation of the size of the pharyngal cavity, than if he varied just the tongue root position alone. One would thus expect larger acoustic effects than if there were no changes in the position of the height of the larynx. And indeed, in Akan, and in other Kwa languages that I have investigated, the function of the variations in larynx height appears to be in increasing the acoustic distance between sets of vowels. We found in the acoustic analysis that the differences in the first formant frequencies between vowel sets were much larger than the differences in the second formant frequencies. Changing the size of the pharyngal cavity affects the first formant more than the second formant.

An attempt was made to tease out the relative contribution of larynx height and pharyngal width to the changes in the formant frequencies. Vowels were synthesized using a line analogue speech synthesizer. This vocal tract model (Rice, 1971) calculates the formant frequencies for a given vocal tract shape. It is possible to change the length of the pharynx by deleting the first section above the larynx. This is equivalent to raising the larynx 1 cm.

An [i]-shape and an [u]-shape were generated on the model, and the tongue root was systematically varied from an advanced position to a retracted position in several steps under two conditions (as illustrated in Fig. 7). Condition 1 was with larynx in "normal", or low, position, and condition 2 was with the larynx raised 1 cm. The effects on the formants were found to be similar to those observed in the Akan data. Raising the larynx makes virtually no difference to either the second or the third formant. The important contribution of variation in larynx height is to the frequency of the first formant. Figure 8 is a graph of the effect of tongue root movement on the first formant in an [i]-shape and an [u]-shape, under the condition of a low larynx (unbroken lines) and under the condition of a raised larynx (dotted lines). The frequency of the first formant is more affected when the tongue root is retracted than when it is advanced. Secondly, the effects from enlarging the pharyngal cavity are larger for [i] than for [u]. The largest effects for both vowels are accomplished by going from an advanced tongue root with a low larynx to the retracted tongue root with a raised larynx—exactly as in fact happens in Akan and other Kwa languages. Changing the height of the larynx here has a definite function in making the vowels of different harmony sets more different from each other than if the larynx height were kept constant. This appears to be the major function of larynx height in Akan. The