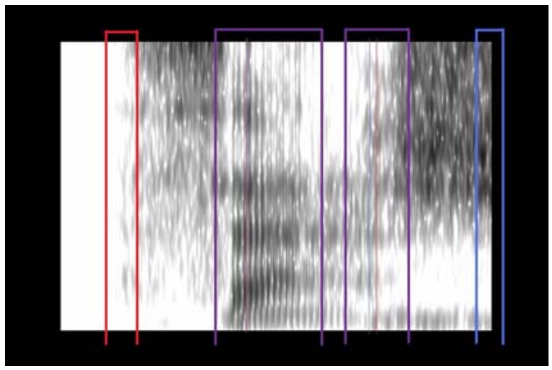
(L) The Whole Spectrum

L1. What words are shown in the last four spectrograms?

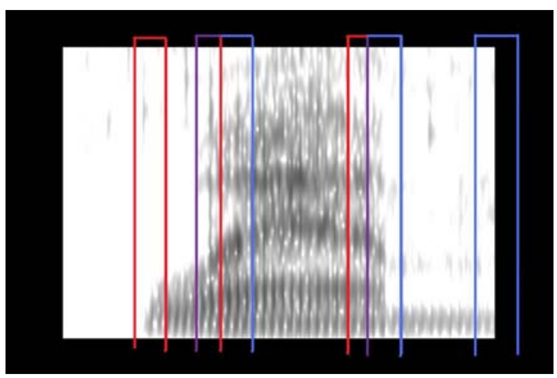
13: Lease	15: Sheep
14: Ash	16: Louse

L2: Mark the intervals corresponding to the three most significant sounds in "sash."



Each left endpoint is correct if it is between the corresponding pair of thick red lines, and each right endpoint is correct if it is between the corresponding pair of thick blue lines. Ideally, there should be significant overlap between the intervals affected by /*s*/ and /*a*/.

L3: Do the same for lamb.



As above. The intervals for /*l*/ and /*a*/ must overlap or be adjacent, and the intervals for /*a*/ and /*m*/ must overlap, since the /*m*/ nasalizes the end of the preceeding /*a*/.

L4: Explain your answers.

When the same basic sound, which is called *phoneme*, occurs in multiple words, it has similar effects. In particular, *s* and *sh* have distinctive appearances, and the vowels have distinctive sets of bars, which are called *formants*. These formants are effected by adjacent consonants in most cases (in fact, some consonants, called *stop consonants* (e.g. *p* and *k*) can be distinguished only this way, hence the seeming lack of a /*p*/ after "sheep"), which suffices to identify the first three spectrograms. Note that the apparent shifting of the formants in the first one does not indicate a diphthong, but is simply a glide from /*i*/ to /*j*/. Also, the difference between /*i*/ (lease) and /*ai*/ (lice) is only an initial /*a*/, so the similarity between the end of, say, "ice" or "mice" and spectrogram 13 is not relevant. The vowel in the last one is not one shown in the previous spectrograms: just as /*ai*/ (as in "mice" or "shine") shifts from /*a*/ to /*i*/, the vowel in the last spectrogram shifts from /*a*/ to /*u*/. The English vowel with this property is /*au*/, so the last spectrogram is of "*louse*."

L5: Discuss the correspondence beteen the spellings and spectrograms of the given words.

Vowels clearly affect particularly long intervals, as do the sibilants *s* and *sh*, which can be said both continuously and loudly. Nasals after vowels also affect long intervals, because they nasalize the preceding vowels, although since the quality of some copies of the problem made this impossible to see, it was not graded. Transitions between sounds are not instantaneous, since the mouth changes smoothly from one position to another, so "intervals" have at least some level of imprecision. For most sounds in this problem, transitions were fairly abrupt, but others, e.g. final stops (initial stops are visible by their aspiration, an initial region of high amplitude) are detectable mostly by their effects on adjacent vowels, although they seem to have no intervals to themselves. With this observation in mind, it is possible to postulate another stop consonant at the start of vowel-initial words, and careful pronunciation of them does indeed reveal an unwritten glottal stop. In the given spectrograms, a glottal stop is present in every vowel-initial word except *e* (the beginning of *e* in the given spectrograms is simply a matter of amplitude, although credit was given for glottal stops even if the only cited example was *e*, as long as some description was given). Also, some diphthongs are arguably not indicated, and the glides that come after English long vowels, such that /*j*/ after /*i*/ and /*w*/ after /*u*/, are not indicated, but clearly visible at the end of, say, "knee." Conversely, certain letters of English orthography are not pronounced at all, such as final silent *e*, the initial *k* in "knee," the final *b* in "lamb," the doubled letters in words like "coo," and other vowel combinations. Most of these were pronounced at one point in the history of English, but as pronunciations changed, the orthography did not follow it.