2.5 Pitch Accents with more than one tone: Bi-tonal accents L+H* and L*+H

All pitch accents described so far have been produced with a single tonal element, either a High (H*) or a Low (L*) aligned with the accented syllable. There are other choices open to speakers however, to convey the prominence (greater relative salience) of words and syllables in an utterance. There are times where two tones, both a High and a Low, are associated with the same prominence-marking event. Such events are called bitonal pitch accents. This section will describe two bitonal pitch accents which have in common a Low tone followed by a High tone as part of the same pitch accent: L+H* and L*+H. The plus symbol (+) is used to indicate that the two tones are associated, and form a single unit: a complex (bitonal) pitch accent. The notational difference between these two pitch accent labels is that the star (*) symbol immediately follows the H symbol in one, and the L symbol in the other. This difference in notation reflects 1) a perceptual difference in which of the two tones lends more prominence to the pitch accent and 2) alignment characteristics of f0 movement in relation to the pitch accented syllable.

2.5.1 L+H* vs L*+H

The examples <amelia1> and <amelia2> illustrate the difference between the L+H* and L*+H. In both of these files, the same speaker produces an L H L H sequence. However, the two utterances have two different intonational contours, where the labels differ only by the location of the star (*) symbol. That is, both contain a bitonal pitch accent on the same syllable (the –*mel*- of *Amelia*), followed by a Low phrase accent / High boundary tone sequence (L-H%), the same break labels, and the same words (*Amelia knew him*), but in one case the prominence is associated with the H* and in the other case with the L*.

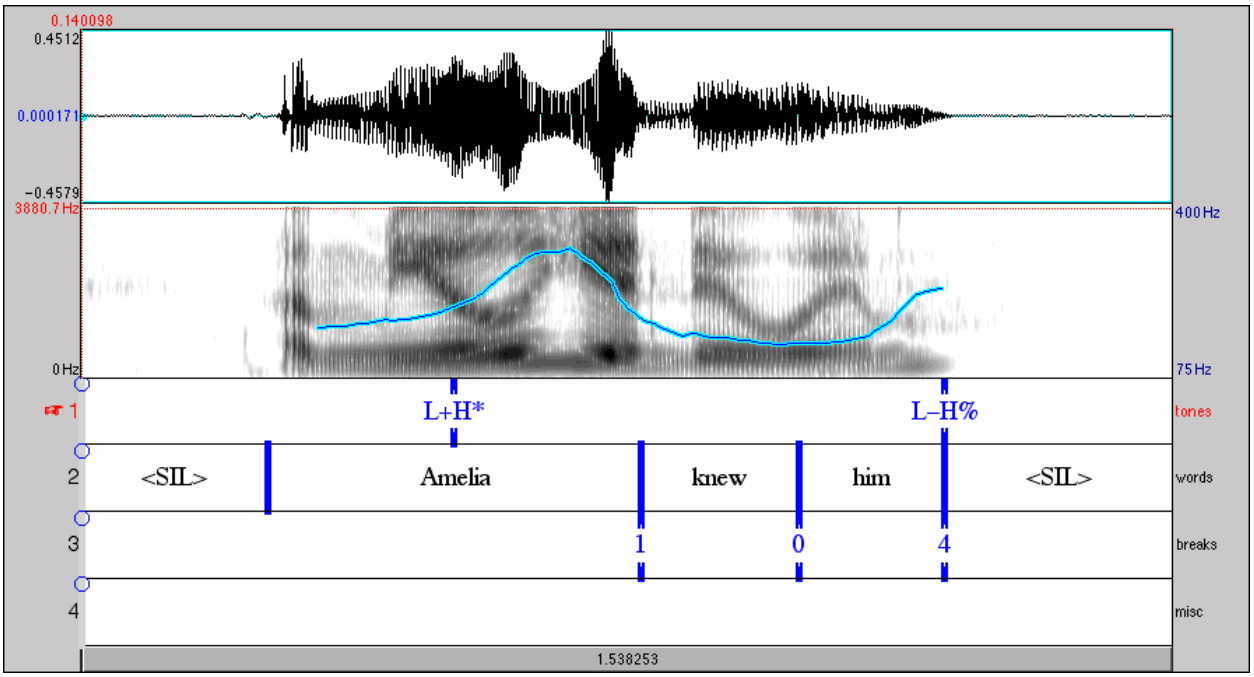

Figure 2.5.1 L+H* <amelia1>

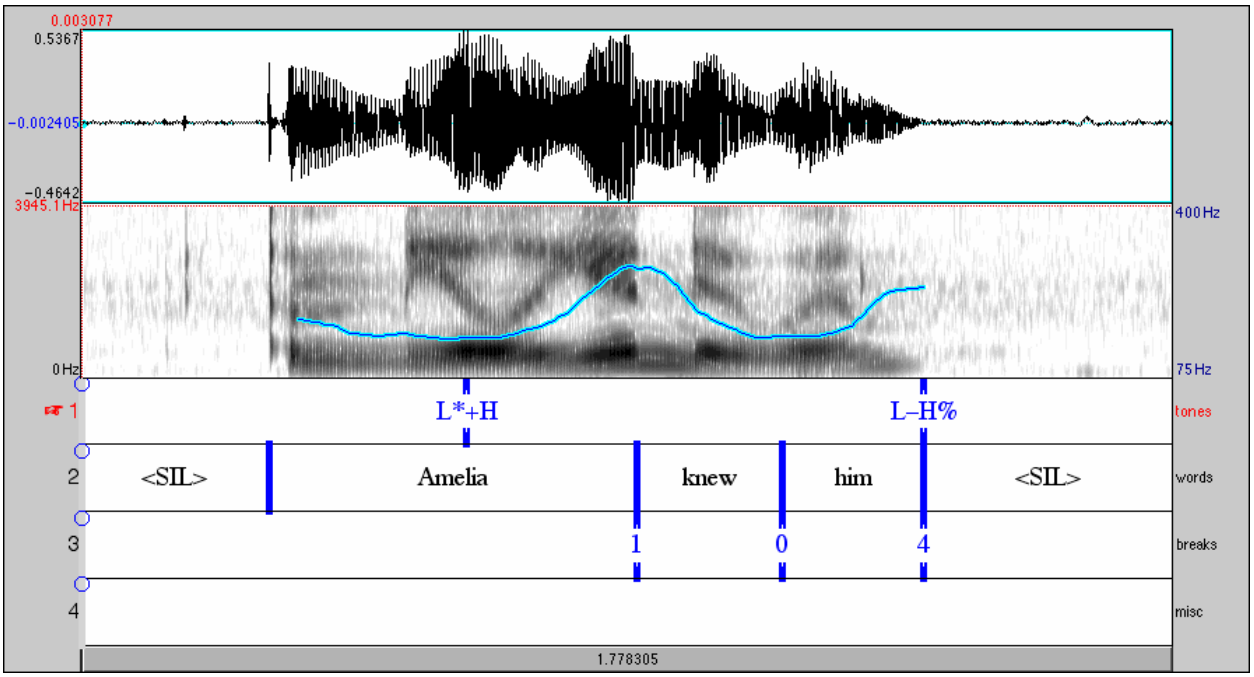

Figure 2.5.2 L*+H <amelia2>

In both files, there is a stretch of low f0 followed by a rise to a high f0 peak, then a fall to another low stretch, and finally a rise to a higher f0. Look closely at how the pitch track aligns with the syllables of the word *Amelia*. In the L+H* example, the H tone aligns with the prominent syllable *-mel-*; the f0 rises through the prominent syllable, with the peak occurring at the end of the syllable. (Note how useful the spectrogram is for figuring out which syllable the f0

movement occurs on, especially when combined with listening to selected time segments of the utterance.) This alignment of the H tone with the prominent syllable corresponds to the perception that pitch accent is one of a High tone prominence—the "starred" tone in this bitonal pitch accent is the H (L+H*). In the L*+H example, the tone aligning with the prominent syllable *–mel-* is Low: while there is a peak corresponding to a High tone, this H tone occurs at the very end of the non-prominent syllable *–ia* (at the end of *Amelia*). The alignment of the L tone with the prominent syllable corresponds to the perception that pitch accent is one of a Low-tone prominence—the "starred" tone in this bitonal pitch accent is the L (in an L*+H). We'll see later that f0 peaks and valleys do not invariably occur on the accented syllable; here we simply illustrate that the L*+H / L+H* contrast is generally reflected in peak alignment differences.

2.5.2 Bitonal vs single-tone pitch accents

The bitonal pitch accents L+H* and L*+H differ from the single-tone H* and L* accents by virtue of Tone events that precede or follow the (starred) H or L target of the pitch accent. Specifically, the L+H* differs from the H* primarily by a more substantial rising pitch movement leading up to the H* target, i.e. the presence of a preceding L target. The L*+H differs from the L* primarily by a rising pitch movement that follows the L* target, i.e. the presence of a following H target.

2.5.2.1 L* vs. L*+H

The difference between the single-tone L* pitch accent and the bitonal L*+H pitch accent is highlighted in the files <amelia3> and <amelia2>. These two files, like the pair of files discussed above, have labels that differ only in the type of pitch accent, here, L* and L*+H. In the L*+H example, shown above in figure 2.5.2, the Low target of the prominent syllable (the *-mel-* of *Amelia*) is followed by a rise to a peak, corresponding to the +H portion of the pitch accent. (The subsequent Low and the final rise of the contour are due to the Low phrase accent and High boundary tone, L-H%). The example with the single-tone L*, <amelia3>, also shows a low f0 on the pitch-accented syllable (again, the *-mel-* of *Amelia*). However, the f0 stays low and flat following the prominent syllable all the way through the end of the word *Amelia*, and then through the word *knew*, until the rise to the H% boundary tone at the end of the word *him*. This difference between the two files reflects the difference between L* L-H% and the bitonal-containing sequence L*+H L-H%.

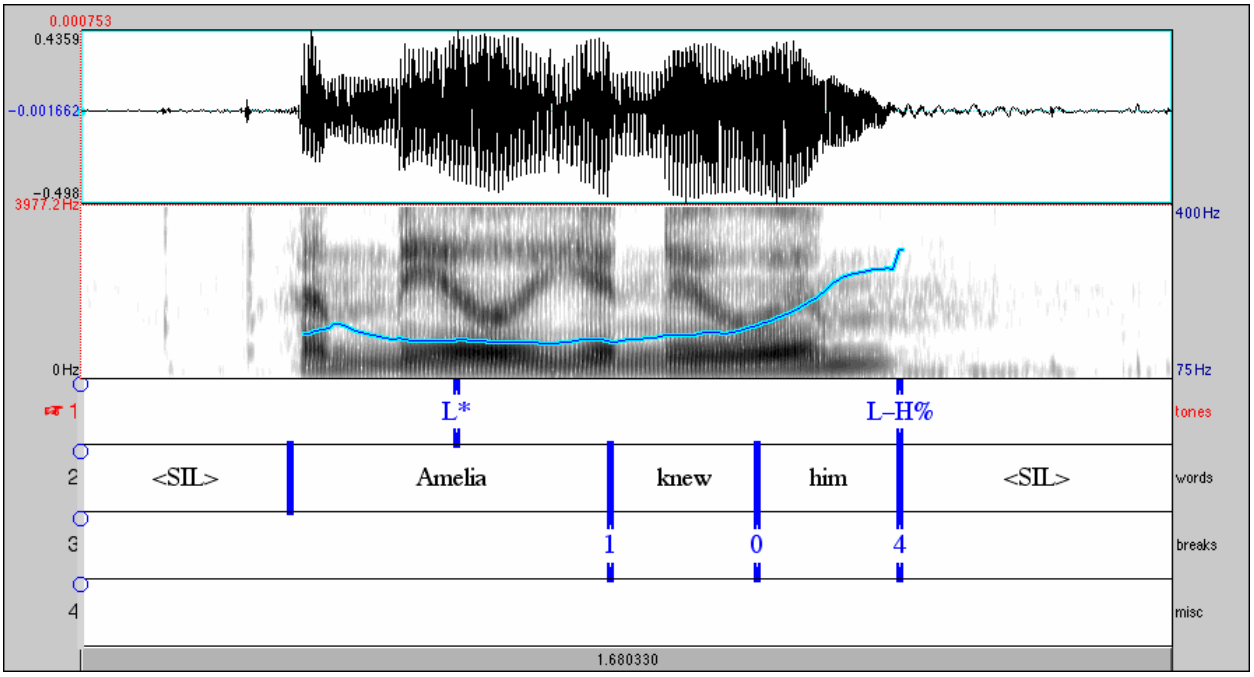

Figure 2.5.3 L* <amelia3>

2.5.2.2 H* vs. L+H*

In the file <amelia4> the now familiar contour H* L-L% is contrasted with a contour containing the bitonal pitch accent L+H*. In both cases, the prominent syllable, the *–mel-* of the word *Amelia*, has a high tone associated with it, and end of the two contours is very similar, as the pitch falls from the high tone into the L-L%. The difference between the two contours is apparent in the pitch events leading up to the peak associated with the High tone of the prominent syllable. In the second intonational phrase of the file, with the tone labels L+H* L-L%, notice the sharp rise in pitch at the beginning of the vowel of the prominent syllable, *-mel-*, towards the peak of the High tone. The f0 at the beginning of the word, while starting at a mid-range, falls through the word-initial vowel *A-* and the following /m/ to a fairly low level. This Low tone is the L of the bitonal pitch accent L+H* in this example. The first intonational phrase in the same file <Amelia> gives a contrasting example of the single-tone H* pitch accent on the same word. Compared to the L+H* version, the rise into the peak of the prominent High tone is gradual from the word onset. While there appears to be a slight fall of the f0 into the /m/ of *Amelia*, this most likely a segmental effect. In any case, the f0 before the H* is not as low as it is for the L+H*.

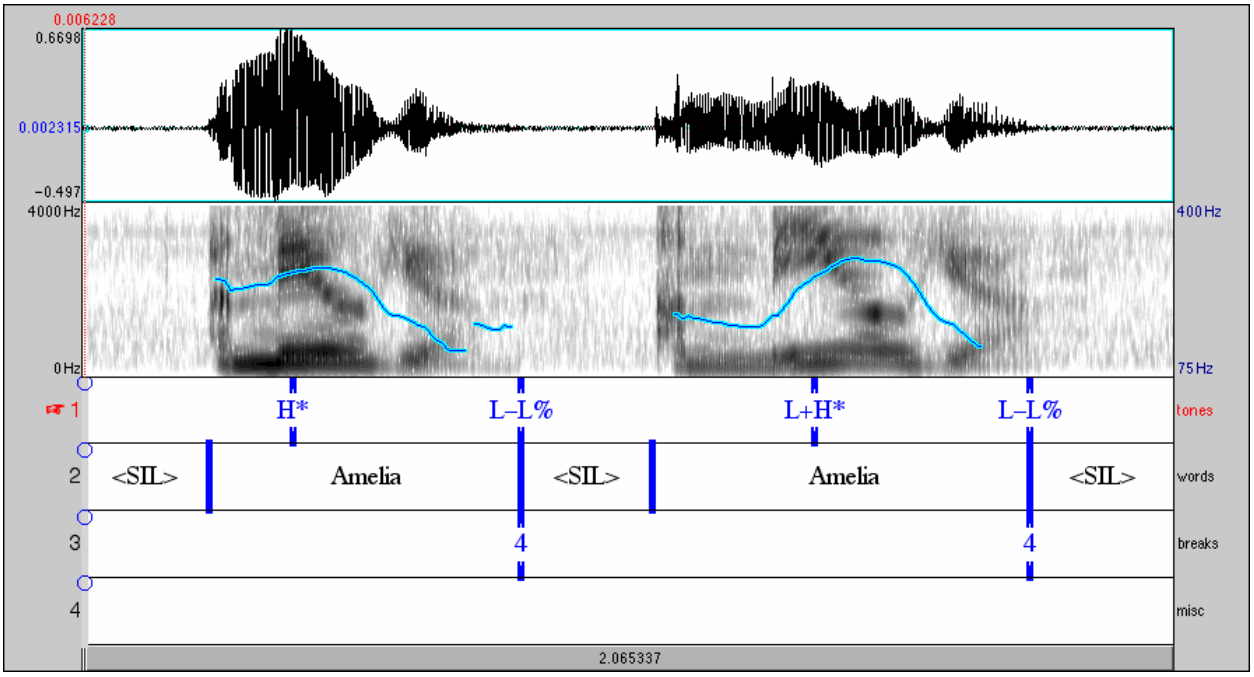

Figure 2.5.4 H* and L+H* <amelia4>

The file <marmalade5> shows another example of the L+H* L-L% contour, this time on the text *Marianna made the marmalade*. Compare this to the earlier example <marmalade2> which has the tone labels H* L-L%. In both files, <marmalade2> and <marmalade5>, the pitch accent is aligned with the prominent syllable, orthographically the second *-a-* of *Marianna*. In <marmalade5>, with the bitonal pitch accent L+H*, the pitch track shows a gradual fall from the beginning of the word *Marianna*, reaching a low in the *–ri-* syllable, then a sharp rise into the High tone of the prominent syllable. In <marmalade2>, with the H* pitch accent, the rise to the peak of the H tone on the pitch-accented syllable is more gradual, starting from the beginning of the intonational phrase and across the first two syllables of the word. (The slightly higher f0 at the very beginning of the word *Marianna* is due to effects of the segment /m/, which the labeller should try to ignore in interpreting the tones of the intonational contour. Since the labeller can generally hear the intended contour "through" these segmental effects, this is an example of how listening trumps looking in labelling.)

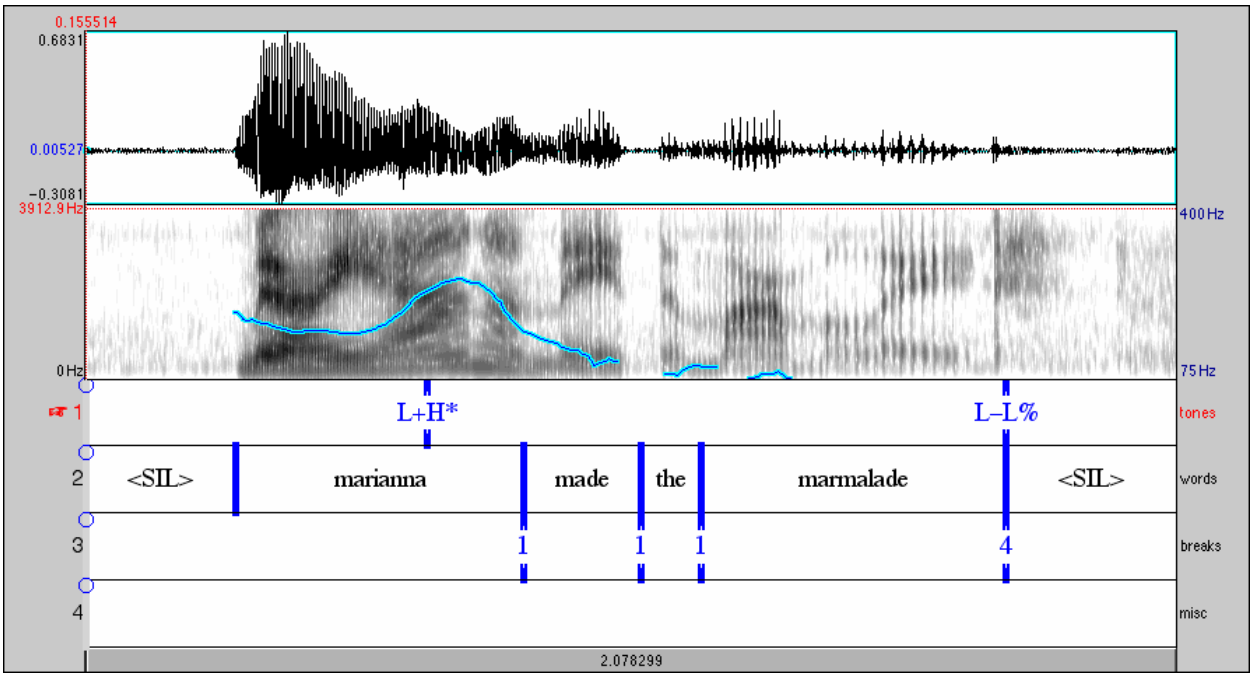

Figure 2.5.5 L+H* L-L% <*marmalade5*>

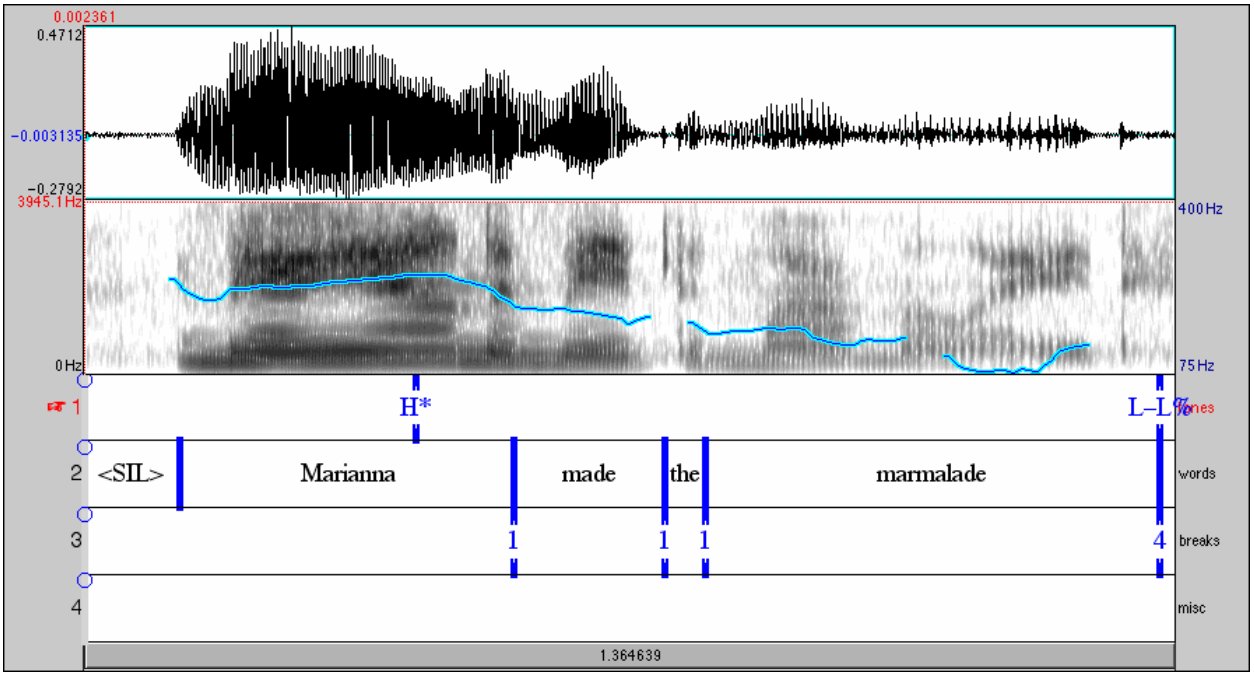

Figure 2.5.6 H* L-L% <*marmalade2*>

Pitch Accent and Meaning
Speakers often use the L+H* pitch accent in contexts of contrast, although its use is not limited to such cases. For example, when saying the word sequence *Marianna made the marmalade*, the contour with L+H* might be used in a context where the speaker is trying to make it clear that the person who made the marmalade was Marianna, as opposed to some other person. In contrast, the example with a H* pitch accent could be expected in response to a question about who made the marmalade:

L+H, as in* <marmalade5>
Speaker A: Bob made the marmalade.
Speaker B: (No.) Marianna made the marmalade.

H, as in* <marmalade2>
Speaker A: Who made the marmalade?
Speaker B: Marianna made the marmalade.

However, it is important to remember that both contours can be used in a variety of contexts, and a specific context will not necessarily lead all speakers to select the same intonation contour.

2.5.2.3 Constraints on the use of the L+H* label

The use of the label L+H* is constrained to places where a low f0 cannot be accounted for by some other tonal event. For example a rise from a Low tone to a High-toned prominent syllable can sometimes be accounted for by a preceding L-L% phrase accent/boundary tone combination, or a preceding L* pitch accent. Cases of L+H* are clearest when there is at least one non-pitch-accented syllable preceding the prominent syllable, so that the L tone of the pitch accent can be realized on preceding syllable(s). Such is the case in the examples discussed above. However, when the pitch accented syllable is the first syllable of an Intonational Phrase, and there is less clear evidence of an initial Low tone (i.e., the f0 rise is small), the conventions of ToBI labelling prescribe using the simple H*. For example, in the file <anna2>, the tone on the pitch-accented syllable *An-* of *Anna* in the first Intonational Phrase of the file is perceptually quite similar to the L+H* on the *Le-* of *Lenny* in the second IP. However, the pitch accent labelled on *Anna* is H*, because there is not sufficient evidence of a Low tone to justify the use of L+H*.

You may have noticed the pitch track at the end of the word *Lenny* in this file <anna2> shows strange squiggles and spikes after the initial smooth fall from the peak into the L-L% phrase accent/boundary tone sequence. This region corresponds to the place in the sound file where the speaker's voice growls or sounds irregular or creaky, which is a common occurrence when speakers produce a pitch that is at the lower end of their pitch range, such as with L-L%. In these regions, pitch periods come at irregular intervals, so there is no regular period for the f0 tracker to track. This irregularity in the pitch periods produces irregularity in the pitch track, i.e. a pitch tracking error, which is a reflection of the difficulty of measuring f0 in regions where a speaker's

voice becomes creaky. Interestingly, you may find that you can nevertheless get a perceptual impression of falling f0 in such regions.

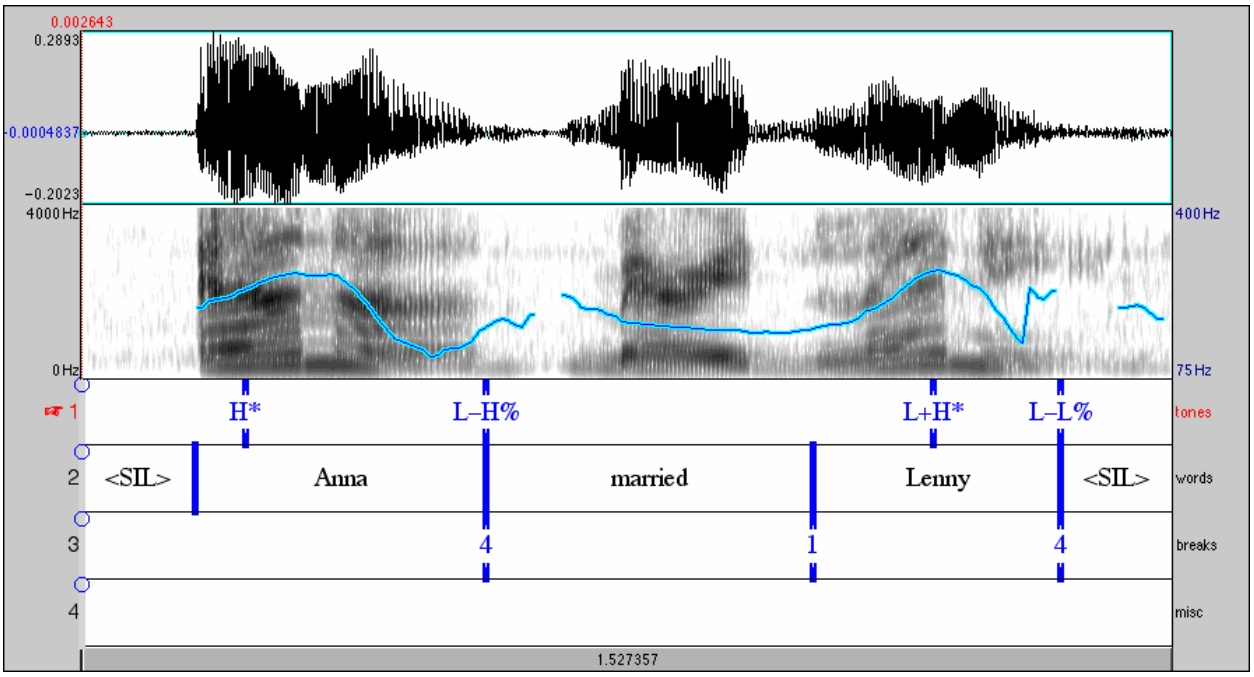

Figure 2.5.7 H* vs. L+H* <*anna2*>

Summary of ToBI labels introduced so far:
Tones:
H*: high pitch accent
L*: low pitch accent
L+H*: bitonal low tone with high tone on accented syllable
L*+H: bitonal high tone with low tone on accented syllable
L-L%: low phrase accent, low boundary tone
H-H%: high phrase accent, high boundary tone

Break indices:
0: word boundary erased
1: typical inter-word disjuncture within a phrase
4: end of an intonational phrase