TABLE OF CONTENTS

1 SEEING THE FRETBOARD

When you speak, do you think about each sentence, each word, each letter, how they sound or look, what they mean, the rules of grammar, spelling, etc., or do you just speak your mind and the words seem to pour out? As a guitar player, how do you "see" the fretboard, the notes, how do you connect theory with what you play, etc.? How do other guitar players see these things? Have you ever made a conscious effort to understand how you process what you've learnt about guitar playing? This introductory chapter aims to heighten your awareness of how you see and think about the fretboard—a brief but necessary guitarist's introspection! We will touch upon a variety of ways of approaching the fretboard. In particular, we will spend some time on viewing the fretboard through intervals, a road less travelled. The last part of the chapter is a refresher on fretboard notation or how the fretboard looks like on paper. We close the chapter by making a statement for a state of mind: the questioning guitarist!

1.1 What do you see?

I'd like to start by asking you a simple question. If I say "C minor chord in 3rd position," what is the first picture that instantly pops in front of you? Your answer might be in Figure 1.1.

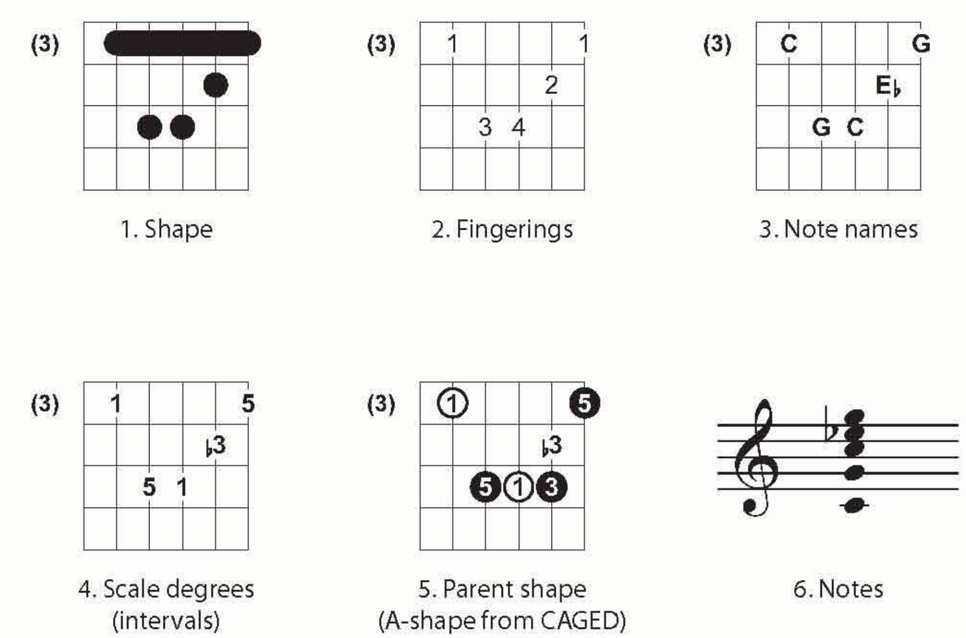

Figure 1.1 *What do you see?*

6 FRETBOARD GEOMETRY

In this chapter, we concentrate on the layout of the fretboard and its properties. Some of these properties originate in the construction of the fretboard and others in the tuning of the guitar. They will help you visualise the fretboard in multiple ways, make connections between all the 100+ notes on it, and prepare the ground for navigating it. This chapter is all about smart ways of looking at the fretboard.

6.1 String intervals

Almost-linear layout

We saw in the Tuning chapter how the fretboard is laid out in standard tuning. The horizontal distance (interval between frets) is a half step and the vertical distance (interval between strings) is 4-4-4-3-4.

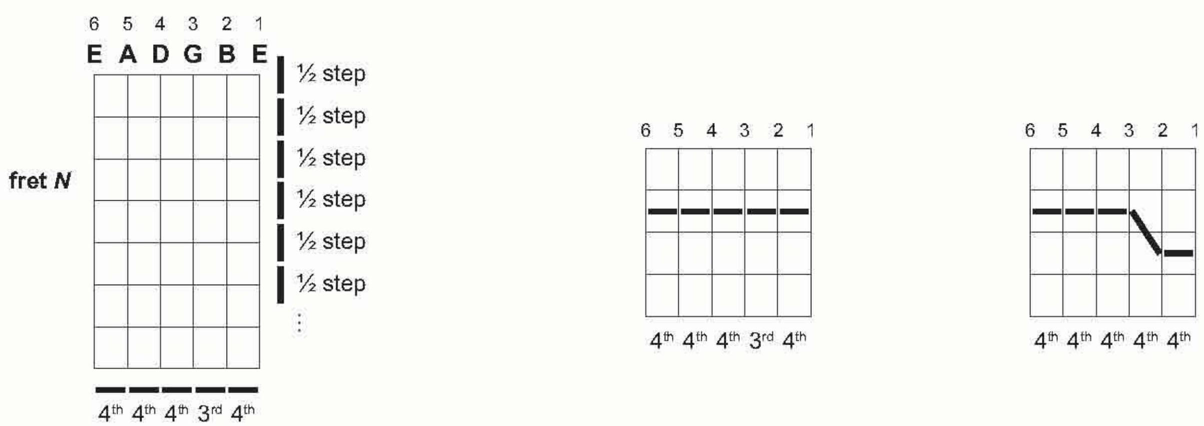

Figure 6.1 *Fretboard's intervallic layout and strings 3–2 half-step shift*

The fretboard's layout would be pretty linear (regularly spaced) if it weren't for the half-step shift between strings 3 & 2. This breaks up the fretboard into two groups: strings 6–3, evenly spaced in 4^{ths}, and strings 2–1, spaced by a 4^{th} too. But the two groups of strings are spaced by a 3^{rd}. Unfortunately, this shift makes learning the fretboard a little more difficult. One way to restore regular spacing is to shift the notes on strings 2–1 down a half step by tuning them up a half step to C and F, resulting in an all-4^{ths} tuning 4-4-4-4-4.

Vertical string intervals

We are now going to turn our attention to the distance between strings: in other words, we travel from one string to another on the same fret. The tuning tells us the distance between every pair of neighbouring strings.

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What about the distance between strings 6 and 4, strings 6 and 3, or strings 1 and 4? We are equipped with the tool to work this out: interval addition. We'll do the first couple of strings together and you can work out the other ones by yourself.

We want to find the interval between string 6 and string 4. From the tuning. we know the intervals separating strings 6–5 (4^{th}) and 5–4 (4^{th}). We also know that in standard tuning, we are ascending in pitch from low to high strings, so we simply add: $4^{th} + 4^{th} = \flat 7^{th}$. This is the interval separating strings 6–4 (i.e., the interval between a note on string 6 and another note on string 4, both on the same fret).

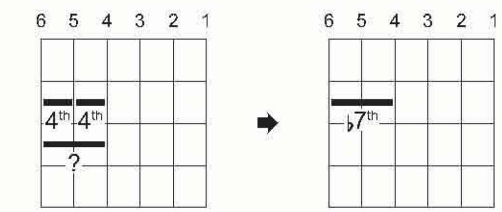

Figure 6.2 *Interval between strings 6 and 4*

Next, we want to find the interval between strings 6 and 3. We just figured out the interval between strings 6–4 and we know from the tuning the interval separating strings 4–3 (4^{th}), so we just add them again: $\flat 7^{th} + 4^{th} = \flat 3^{rd}$. Proceeding the same way with the remaining strings, we figure out the distance between strings 6–2 (5^{th}) and 6–1 (1). Effectively, we are making the note on string 6 the tonic (scale degree 1) and look at the position of each note on the same fret, next string up, with respect to that tonic's major scale.

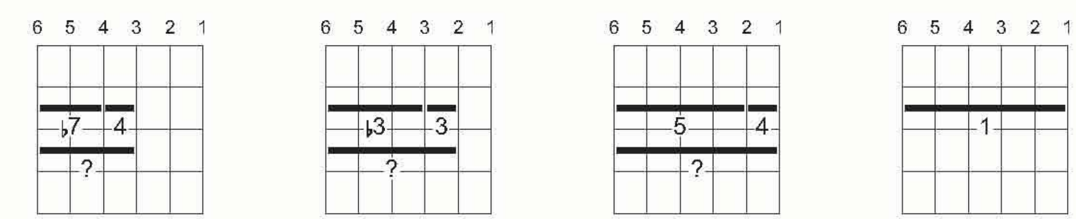

Figure 6.3 *Intervals between string 6 and other strings*

In terms of scale degrees, if the note on string 6 is the tonic 1, then the note on string 5, which is a 4^{th} above it, is the 4^{th} degree of the scale. Likewise, we can write the scale degrees on the other strings, for the tonic 1 located on string 6.

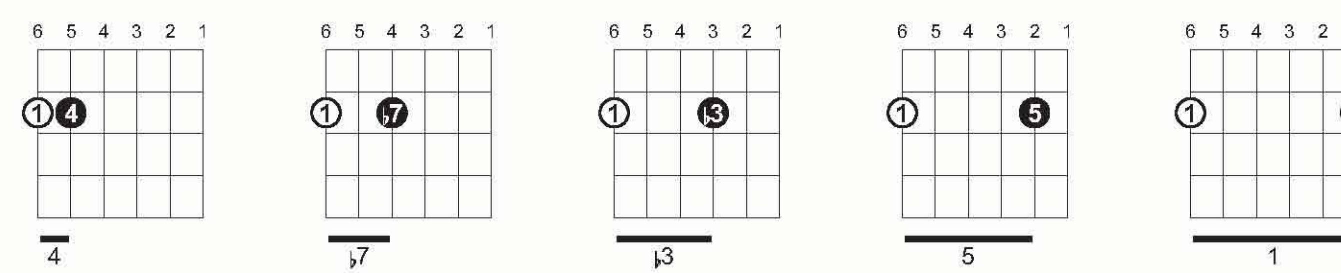

Figure 6.4 *Scale degrees between string 6 and other strings*

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Octaves

Octaves on a string are a subset of octaves across all strings. A note appears multiple times on the fretboard, either at the same pitch, or at octaves. The patterns formed by these notes are commonly referred to as *root shapes*.[2] They're like the backbone of the fretboard. Each shape spans 3–4 frets, and fits nicely within a position (i.e., the notes the left hand can cover without lifting the hand off the neck). Learn to see each shape individually. Then learn these shapes together on the neck. Each shape has at least one note in common with its neighbouring shapes. A popular application of these shapes is to find note names on the fretboard: as long as you know the location of one note name, you can find all occurrences of that note name on the fretboard. For example, if you know the note name on string 6, you can find the same note on string 4 (two frets up) and string 2 (another 3 frets up). Likewise, if you know the note name on string 5, you can find the same note on string 3 (two frets up) and string 1 (another 3 frets up). So by learning note names on strings 6 & 5, you can quickly find those notes on the other strings.

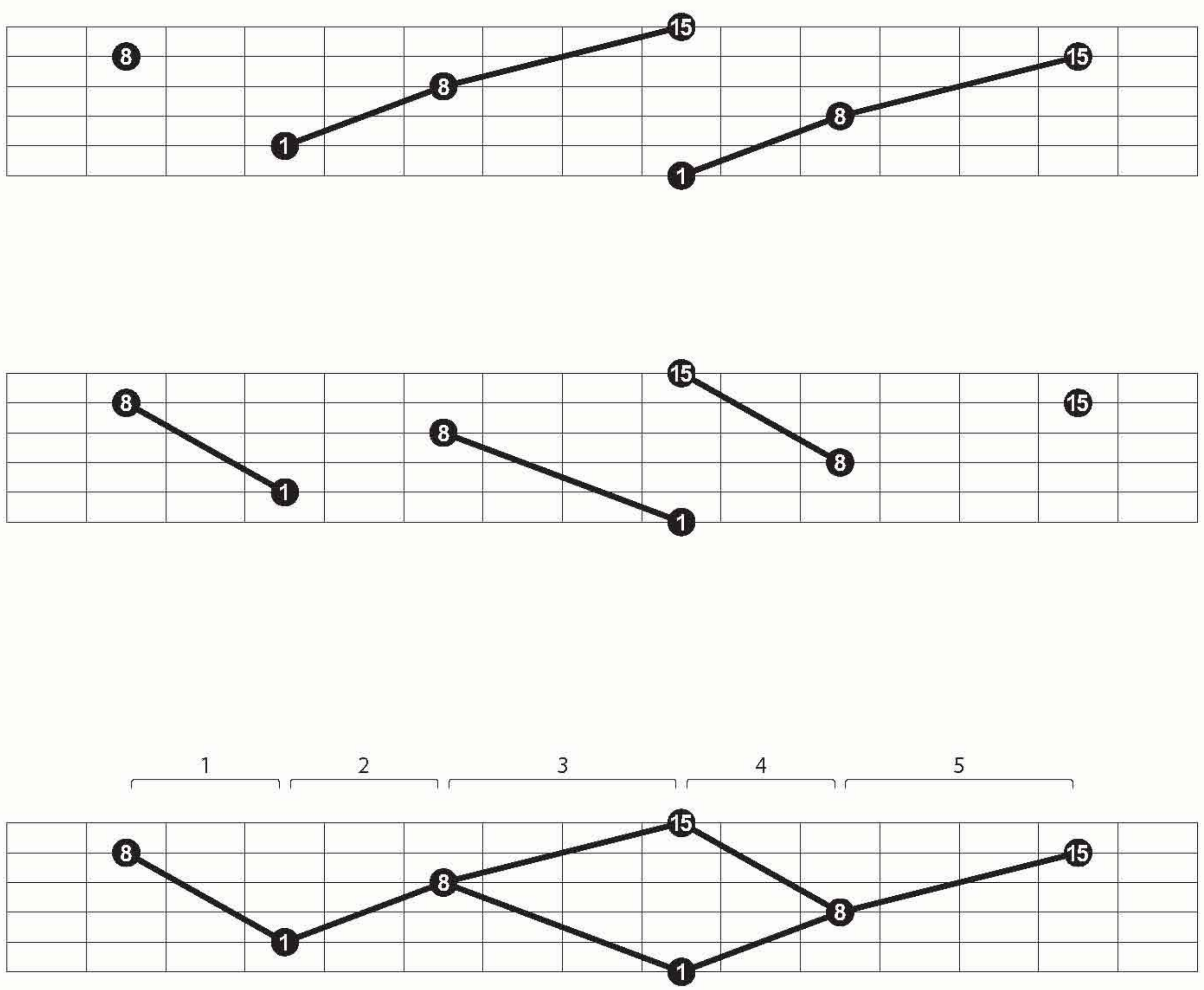

Figure 6.16 *Octaves*

2. A more accurate name is *octave shapes* because root implies chords and these shapes apply to anything (chords, scales, etc.), not just chords.

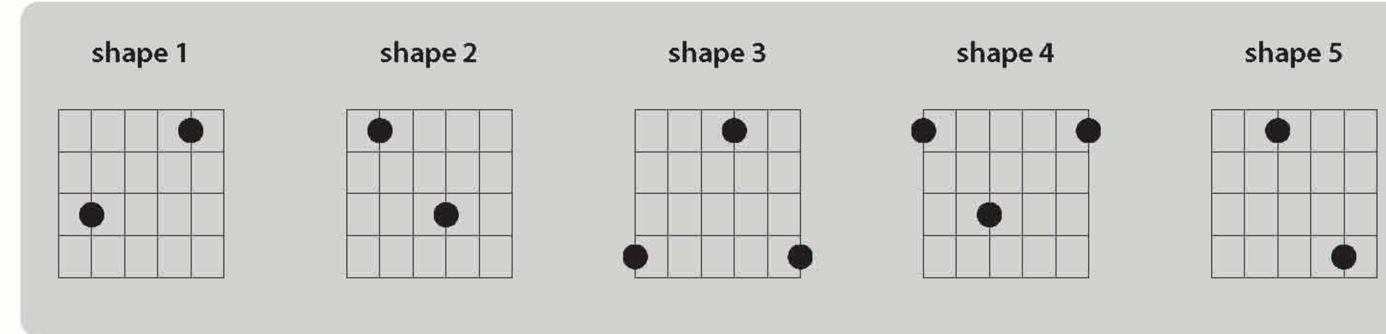

Figure 6.17 *Octaves grouped as root shapes (pictured vertically)*

1, 8, 15 are indicative of relative pitch and labelling depends on the placement of 1. I generally choose to ignore the sign of intervals in this book, to lessen clutter, but be aware of the relative pitch between notes.

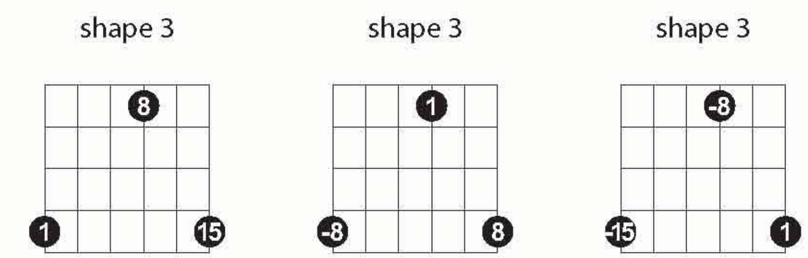

Figure 6.18 *Changing the relative order of pitch*

An equally important view of root shapes is the ability to visualise two neighbouring shapes together. Figure 6.19 shows the neighbouring octaves to a note labelled as 1, for every string. These octaves can be above (8, 15) or below (–8, –15) the root note 1 being considered. The two outer diagrams are the same except for the position of 1.

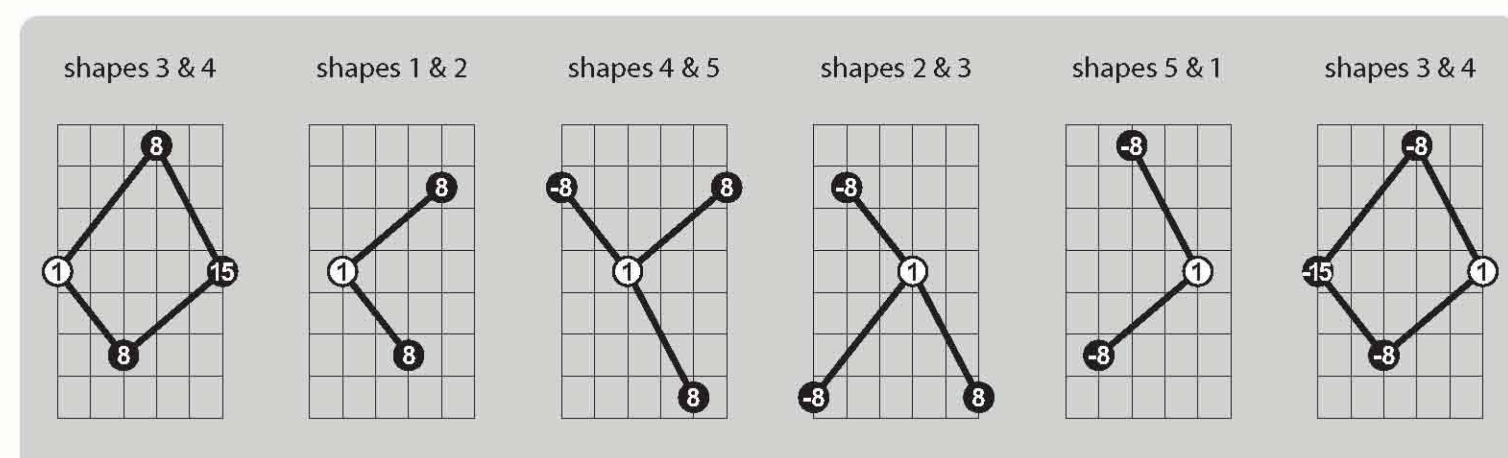

Figure 6.19 *Neighbouring root shapes*

fretwire N to the bridge. So the harmonics map is shifted towards the bridge and its spacing is compressed, just like frets. The new harmonics map is the same with fret N now acting as fret 0: simply shift all natural harmonics by N frets towards the bridge. The example in Figure 11.21 shows how harmonics shift two frets up towards the bridge when fretting the string at fret 2.

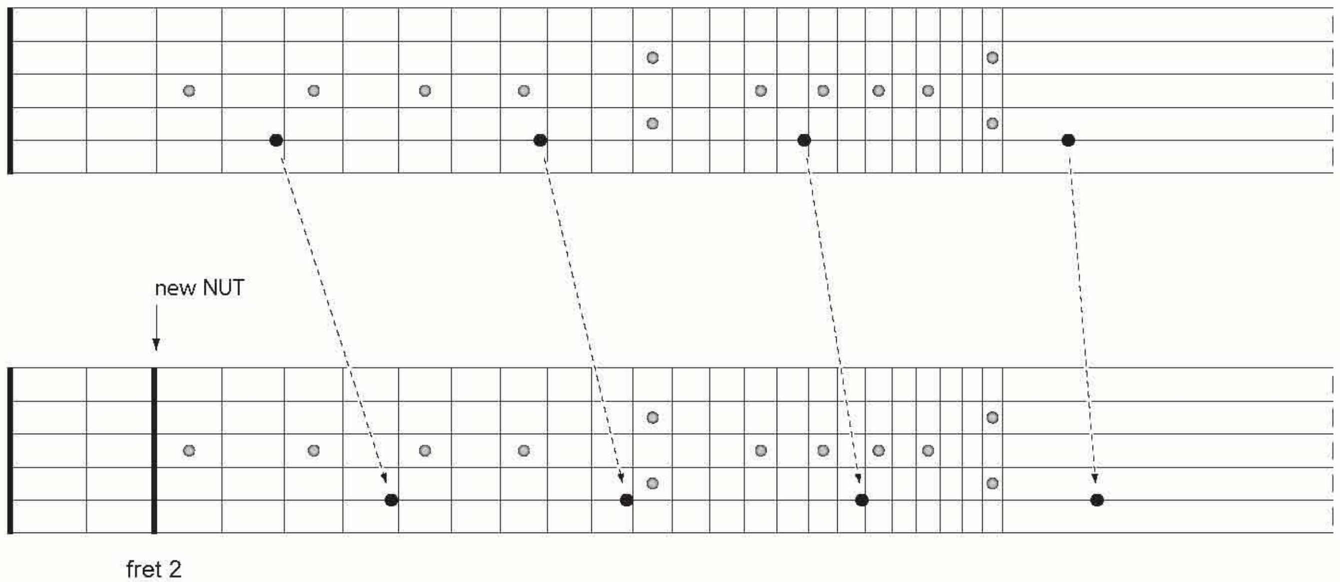

Figure 11.21 *Transposing harmonics to fret 2 (shown for 5^{th} harmonic): shift nodes 2 frets up*

11.5 How to produce harmonics

Since you now understand the mechanism behind harmonics, you know that frets are not involved in generating them. All you need is the string and two posts—the nut (or fret subbing as nut) at one end of the string and the bridge at the other end. You simply need to know the specific points on the string to reach for to get a harmonic (like acupuncture!). Harmonics generated with an open string are called *natural harmonics* and harmonics generated with a fretted string (stopped note) are called *artificial harmonics*.[6] This distinction is only one of terminology and the underlying method to generate the harmonic is identical in both cases.

Isolating a harmonic

What do we mean when we talk about harmonics on guitar? So far, we have defined harmonics and we know that the waveform of a vibrating string is the superposition of an infinite number of harmonic waveforms. We have located where, along the string, each harmonic has its nodes, and have characterised several properties of harmonics (frequency, associated note, etc.). But can we extract a particular harmonic and hear its sound? By performing a specific manoeuvre on the vibrating string, it is possible to isolate the harmonic of order N, and all its multiples (harmonics of order $2N$, $3N$, $4N$, … , $k \times N$, where k is an integer). This manoeuvre doesn't discriminate between harmonic N and its multiples: we get them all! But amongst all these harmonics, the sound of the lowest order harmonic is usually dominant—what we mostly hear—and we simply talk of the N^{th} harmonic, ignoring the higher order multiples that also make up the sound.

6. There is nothing "artificial" about artificial harmonics. They are bona fide harmonics, just like natural harmonics.

In the example of Figure 11.22, we have a vibrating string on a guitar of scale length L. That vibrating string, at any time t, is made of the superposition of the fundamental and its harmonics.[7] We want to extract the 3^{rd} harmonic (h3). That harmonic has two nodes, where at all times, the associated waveform stands still (does not swing up and down). Let's focus on the node marked by a dot in the figure. We see that all other harmonics are moving up and down at that node, except for multiples of the 3^{rd} harmonic (6^{th}, 9^{th}, 12^{th}, $k \times 3$ harmonics). By placing a finger on the string at that node and quickly removing it, we choke all vibrating harmonics, except those with a node (a zero) at that location. The harmonics with a node at that location stand still at the node anyway, whether we poke the string or not. Therefore, those harmonics will keep vibrating after we poke the node with our finger. The resulting waveform is only made of harmonic 3 and its multiples $k \times 3$ (usually sounding a lot weaker). This is how we can manually extract the 3^{rd} harmonic.

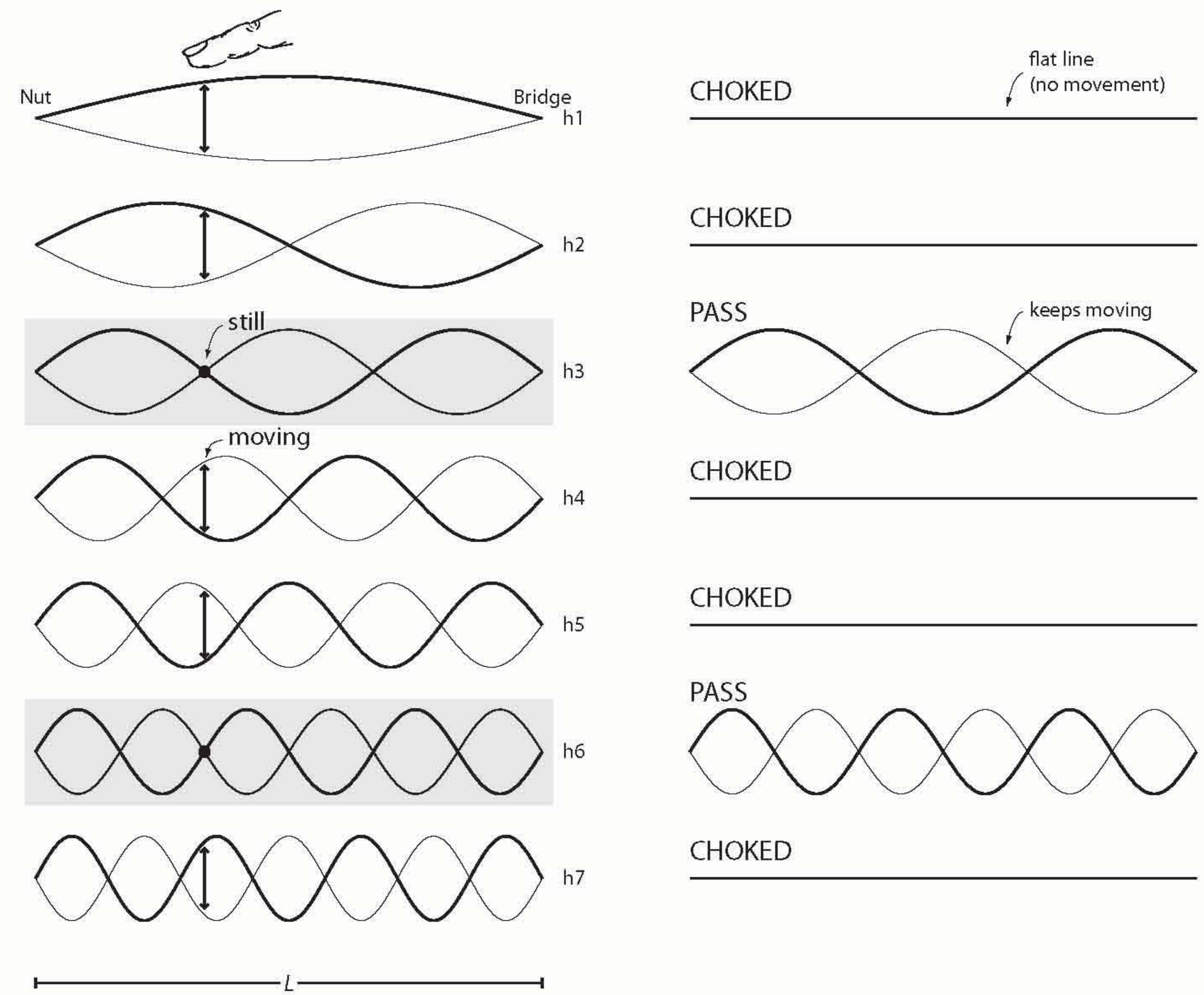

Figure 11.22 *Generating the 3^{rd} harmonic*

The flesh of the finger makes contact with the string not just at the node but on a tiny stretch of string around the node too. So the string's vibration will be choked at the node and dampened on that stretch. This is another reason why higher order harmonics (shorter wavelength) sound weaker.

7. To better show each harmonic, the amplitudes are not to scale and are shown at their maximum swing