

Manfred Bartmann's East Frisian Tea tin Bow. A Short Introduction

The East Frisian tea tin bow was invented by Manfred Bartmann with the help of his father Karl Bartmann (*1923). It was first presented on a Friday morning, 2015/10/02, on the occasion of the 1st symposium of the ICTM (International Council for Traditional Music, a non-governmental organisation in formal consultative relations with UNESCO) study group on African musics at the University of Kwazulu-Natal in Durban, South Africa, there forming part of the African Cultural Calabash Workshops, chaired by David Dargie, the pioneering scholar on Xhosa music (Dargie 1988), under the heading

Pressing down String and Plank: A Musical Bow allows Pitch bending
(Symposium theme: African bows, fiddles, harps, guitars).

Bartmann's musical bow consists of a plank clamped onto a table. It is resonated by a tea tin common in East Frisia. Please note that the tea tin is not fixed, it also serves as a moveable bridge. For this paper, the bridge was adjusted to divide the string at a ratio 3:4, thus making up a fourth interval between the two portions, in this case G/c'. Please compare the photos in this document. The **Table** gives an overview of how some modulations of timbre were explored. The following pages illustrate 9 of these explorations by using photos as well as sound images (spectrograms). These pages also contain the corresponding audio-files (see **Fig. 1-9**).

Please note that a spectrogram is just a visual representation of an acoustic signal. It shows how the spectral density varies with time (horizontal). Degrees of amplitude are shown at various frequencies on a vertical axis. Two types of spectrograms are displayed:

1. Within the coloured ones the degrees of amplitude are represented white- blue- green- yellow- orange- red dark- red black, as in white = no energy, black = lots of energy. The vertical axis is logarithmic. Of course the fundamental pitches are not the only constituents of the music. More likely the listener is asked to focus on modulations of timbre. This is typical for musics intended for so-called formant oriented listeners. Please compare the CD Bartmann 2011, track **05 Sara at Ease** as well its corresponding booklet-entry (3 pages). Concerning formant-oriented listeners vs. listeners who orient themselves to pitches which here correspond to the lowest frequency in the harmonic series, the so-called fundamental frequency, which in these sound samples often appears to be surprisingly weak, please refer to the 7-page essay there **Black African Musics. A Short Introduction by Manfred Bartmann** (= IntrBlackAfricanMusics.pdf). As changes of timbre also may affect pitch perception, please note that the relation between frequency and pitch should not be regarded as just 1:1.

2. Other spectrograms displayed here are grey-scaled. They come with a linear vertical frequency-axis, showing the first three formants of the respective signal against time. Formants are traces of acoustic resonances. They were extracted from the audio signal using the Dutch application 'PRAAT - doing phonetics by computer' (APP Boersma/ Weenink 2015), after having studied Rubin (1982). Formants are displayed here as though they were single sine waves. The algorithm needed to extract them from any acoustic signal is sometimes called sine-wave synthesis. The results are often referred to as sine-wave speech. These sounds may remind one of the warbling sounds of R2-D2, an astromech droid, popularised by the Star Wars movies.

All sound images will become more understandable when viewed in conjunction with listening to the sound samples. Their playback requires an applicable PDF-viewer. © Adobe Reader XI will do.

Please explore whether what you see is what you hear !

On Manfred Bartmann's CD Frisia Orientalis II: Making Music Of Speech © 2017 Manfred Bartmann, the tea tin bow appears in two tracks, 1 Living it up and 5 Rökeldoab Dada. There are two more documents providing psychoacoustics-oriented background information in this section, one on

Endless Series and another one on Sine-Wave Speech. There is also a list of references for further reading. Please also note the **DISCLAIMER** concerning the web sites mentioned within these accompanying documents.

To identify changes of sound quality, 9 explorations come as A/B testings (or comparisons, see **Table**). The method of A/B testing requires the listener to note the similarity or dissimilarity between two sound versions, **a)** and **b)**. Version **b)** always is modified in some respect. So **a)** will always serve as an indication of a specific sound to function as a point of departure while **b)** is offered as an invitation to the listener to recognise and to respond to any changes of sound quality.

Audio file/ string segment/ pitch	right hand			left hand		
	beater (chop stick)		plektrum / how ?	damping the resonator		pressing the plank
	WHERE to strike ?	HOW to strike ?		where ?	PLUS pressing the left segment	
1ab/ left/ c'	a) down the middle, then b) close to the resonator	with the tip	--	--	--	--
2ab/ left/ c'	a) down the middle, then	with the tip	--	--	--	--
			--	b) the bottom	--	--
3ab/ left/ c'	a) down the middle, then	with the tip	--	--	--	--
			--	b) up front	--	--
4ab/ right/ G	a) down the middle, then	with the tip	--	--	--	--
			--	b) the bottom	--	--
5ab/ right/ G	a) down the middle, then	with the tip	--	--	--	--
			--	b) up front	--	--
6ab/ right/ G	a) down the middle, then	with the tip	--	--	--	--
			--	b) the bottom	... with the little finger	--
7/ right/ G	a) close to the resonator		--	--	--	--
		b) w. different segments of the beater	--	--	--	--
8ab/ right/ G	--	--	a) vertical b) horizontal	--	--	--
9/ right/ G	a) down the middle, then	with the tip	--	--	--	--
			--	--	--	b) on the left

Table: Exploring various timbres of the East Frisian tea tin bow using A/B testings. The blue arrows will indicate how an initial sound a) is generated, and then lead to an explanation how a) is modified to b). © Manfred Bartmann 2017.

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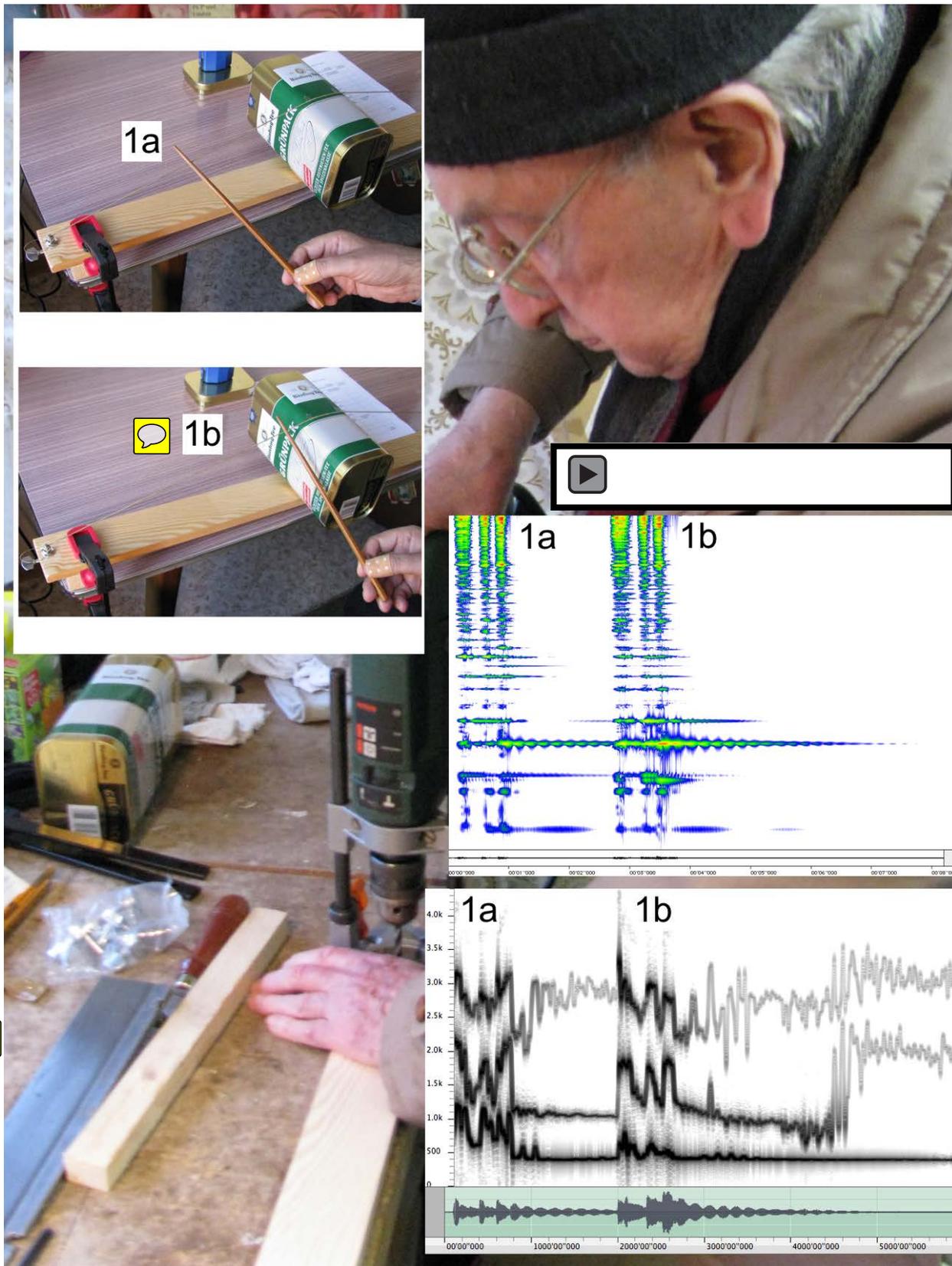


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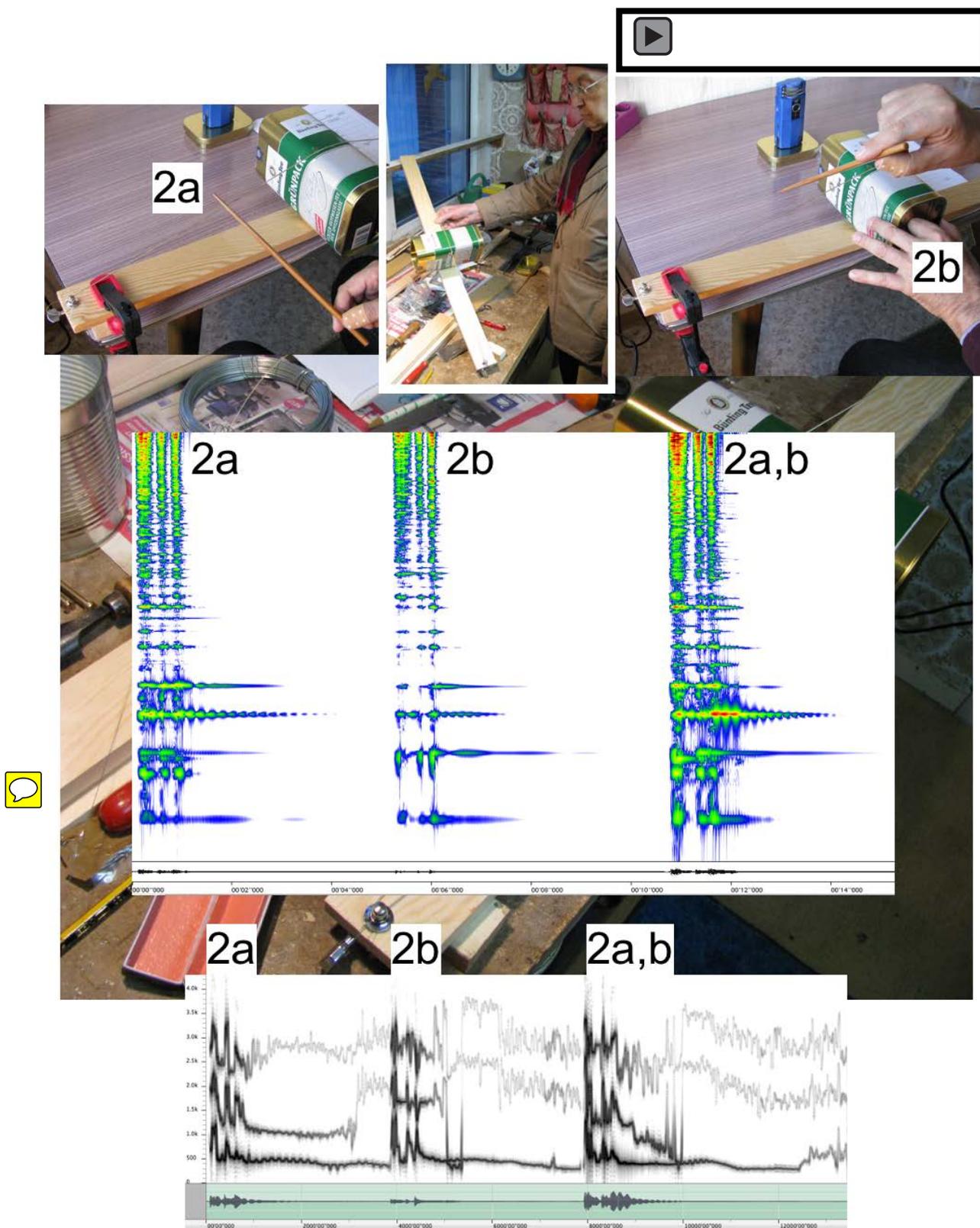


Fig. 2 © Manfred Bartmann 2017. Some photos © courtesy of Karl Bartmann 2015.

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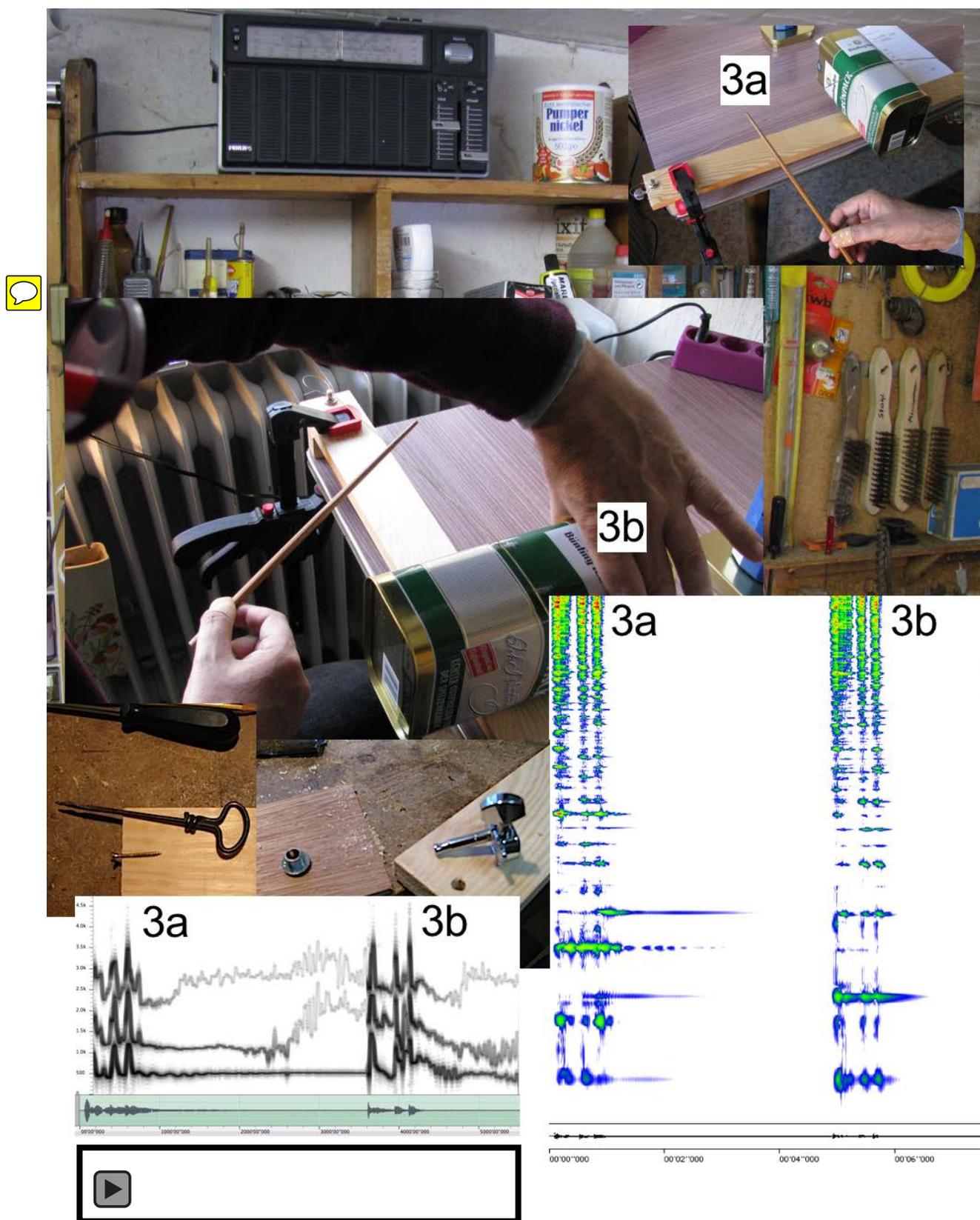


Fig. 3 © Manfred Bartmann 2017. Some photos © courtesy of Karl Bartmann 2015.

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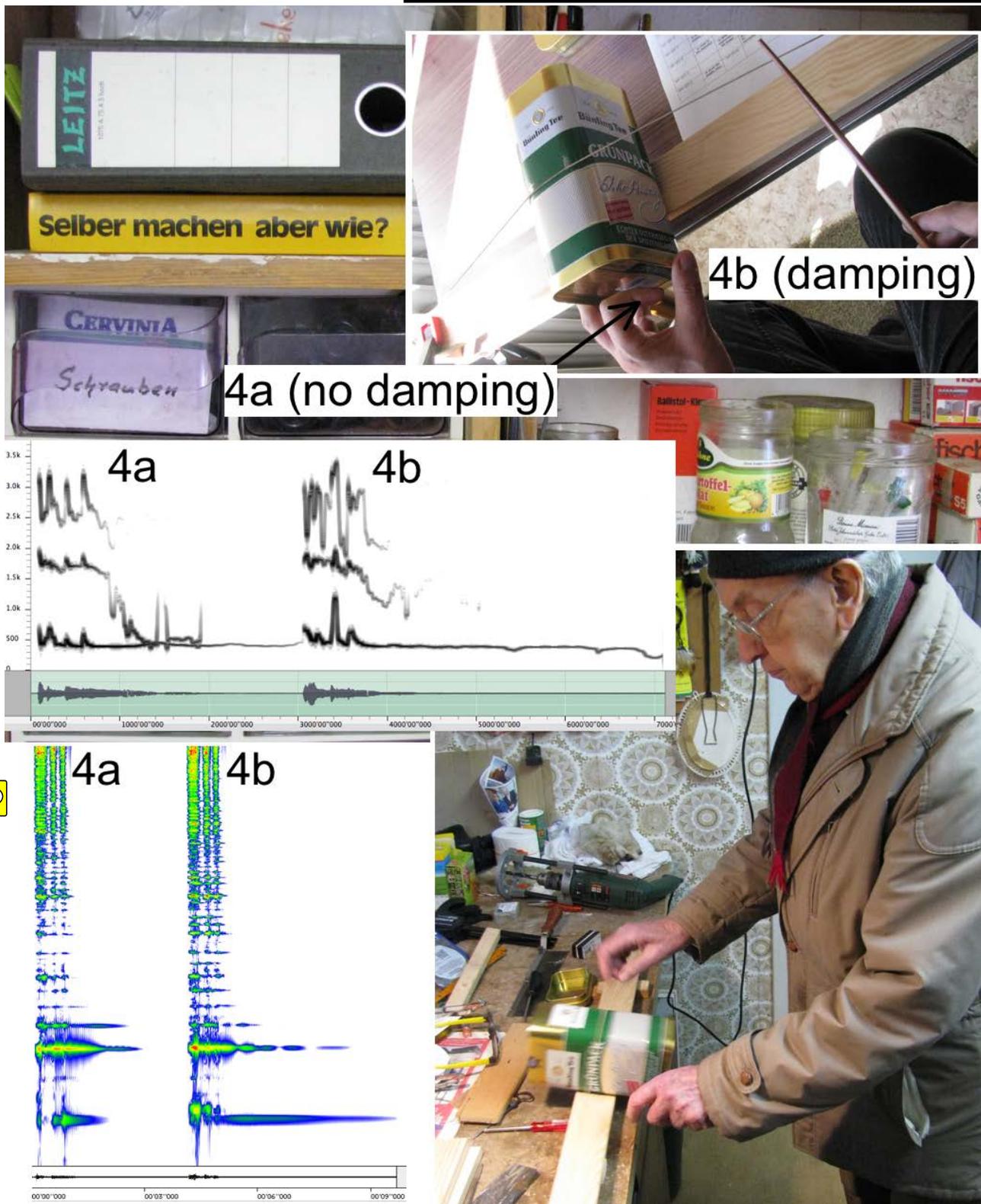


Fig. 4 © Manfred Bartmann 2017. Some photos © courtesy of Karl Bartmann 2015.

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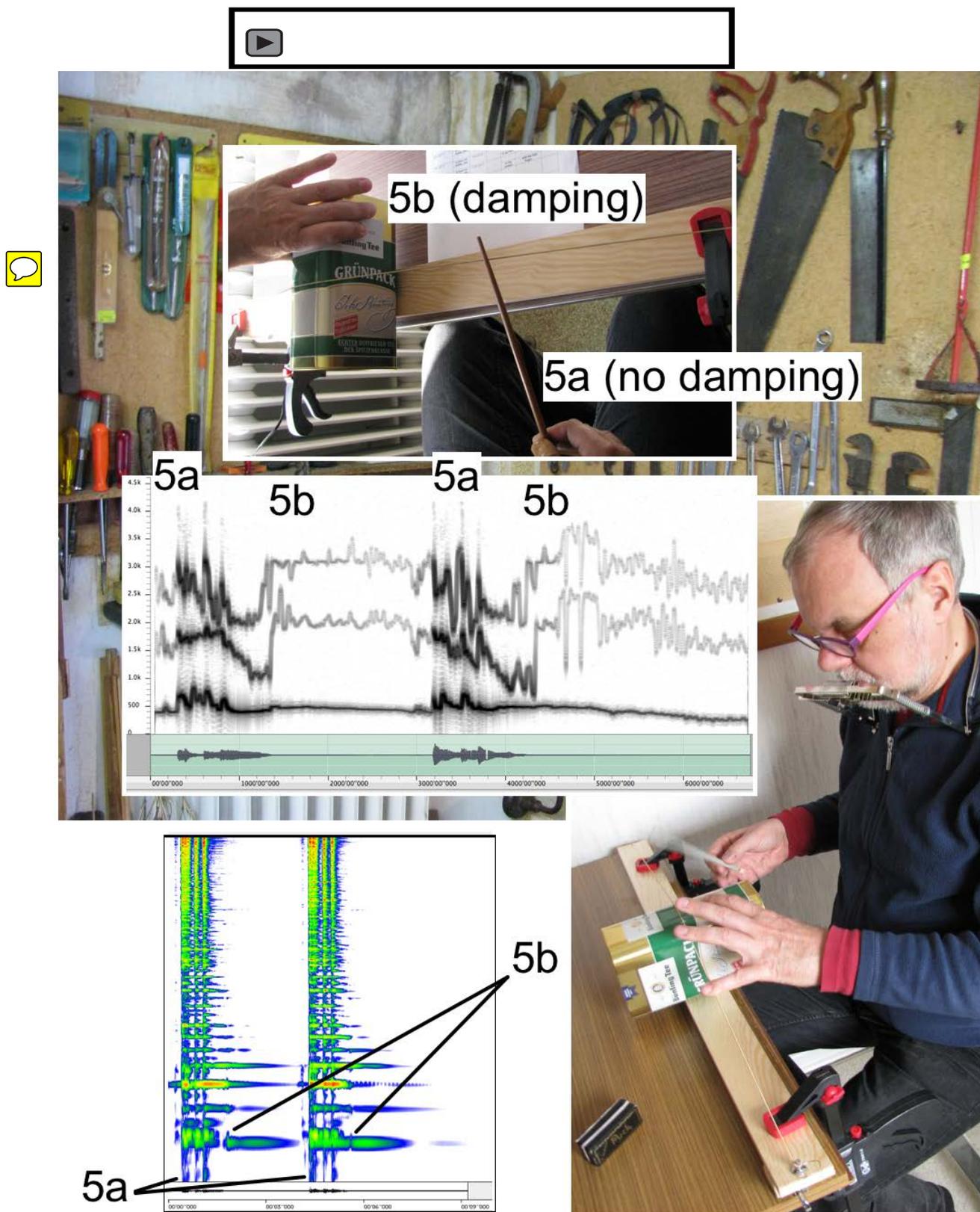


Fig. 5 © Manfred Bartmann 2017. Some photos © courtesy of Karl Bartmann 2015.

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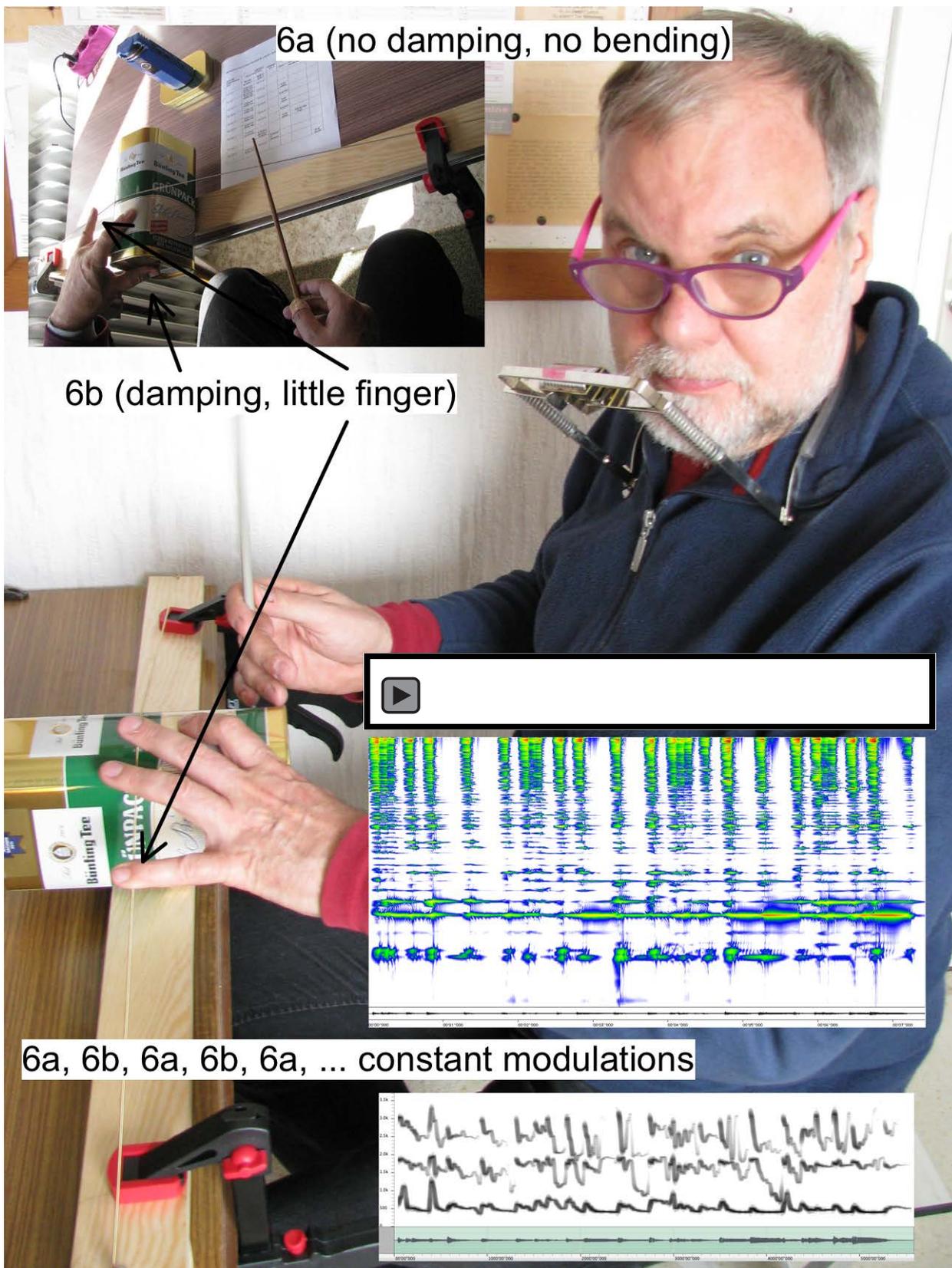


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7 Other modulations ...

Striking close to the resonator ...

... using different segments of the beater



Recording device ZOOM Q3

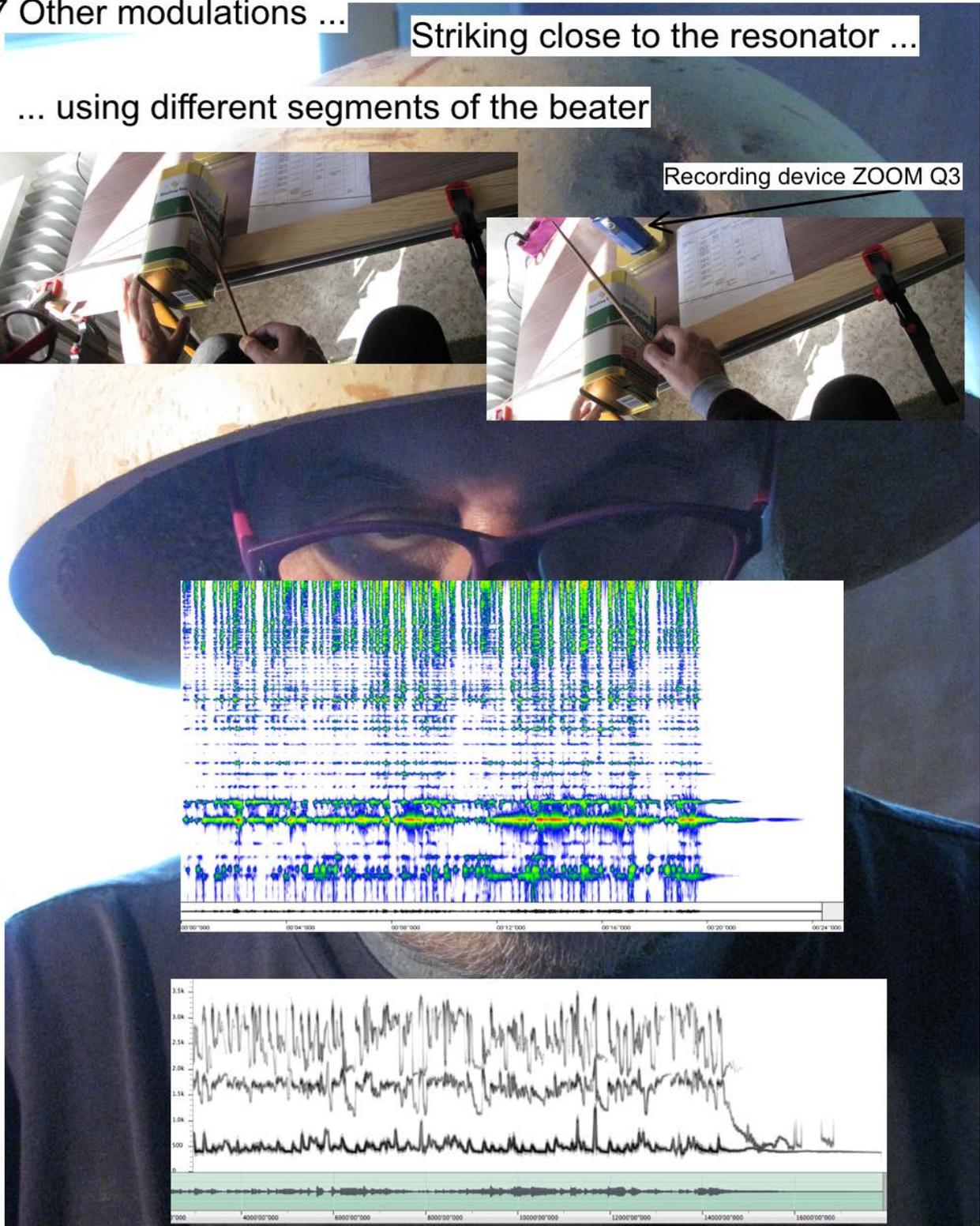


Fig. 7 © Manfred Bartmann 2017. Some photos © courtesy of Karl Bartmann 2015.
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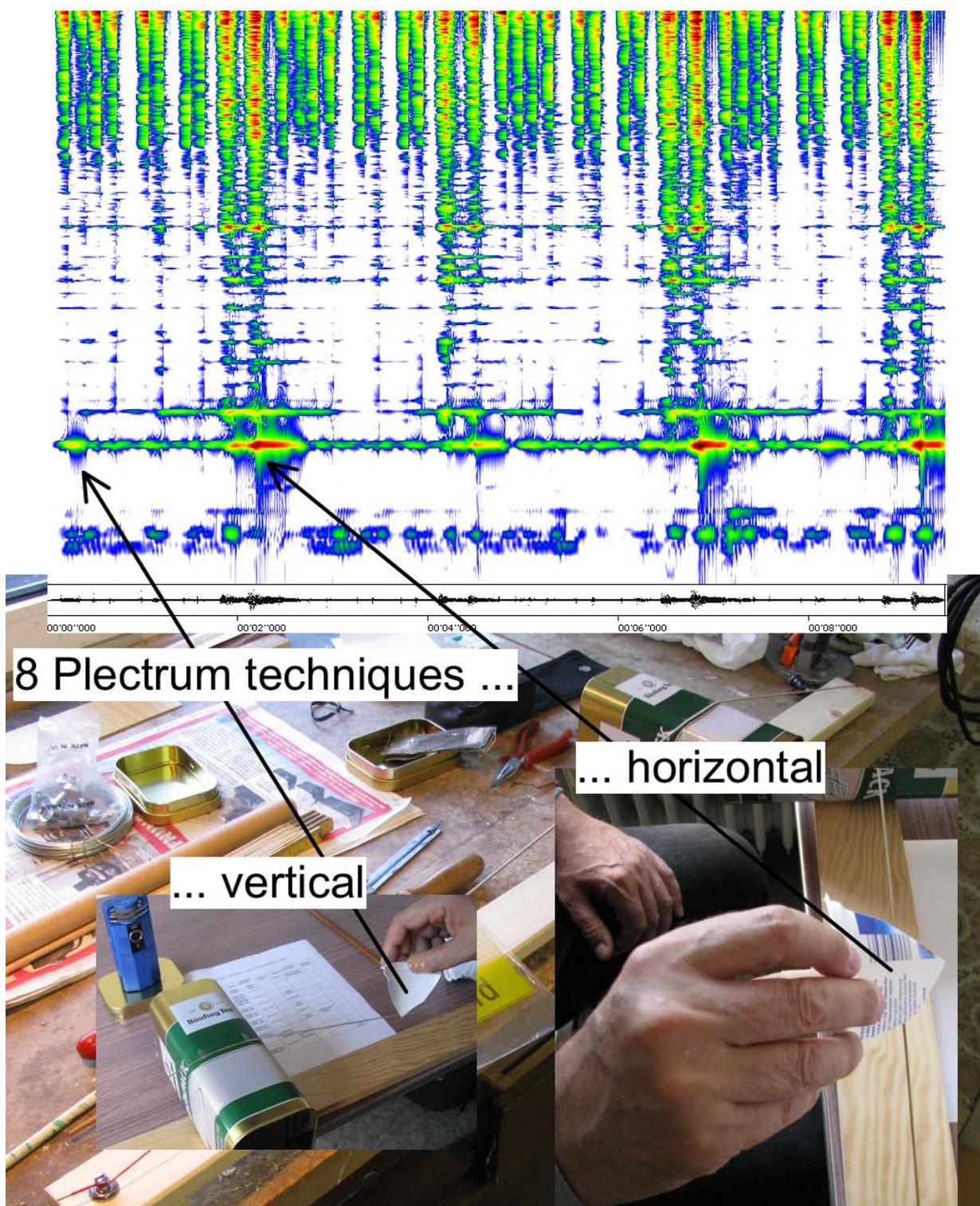


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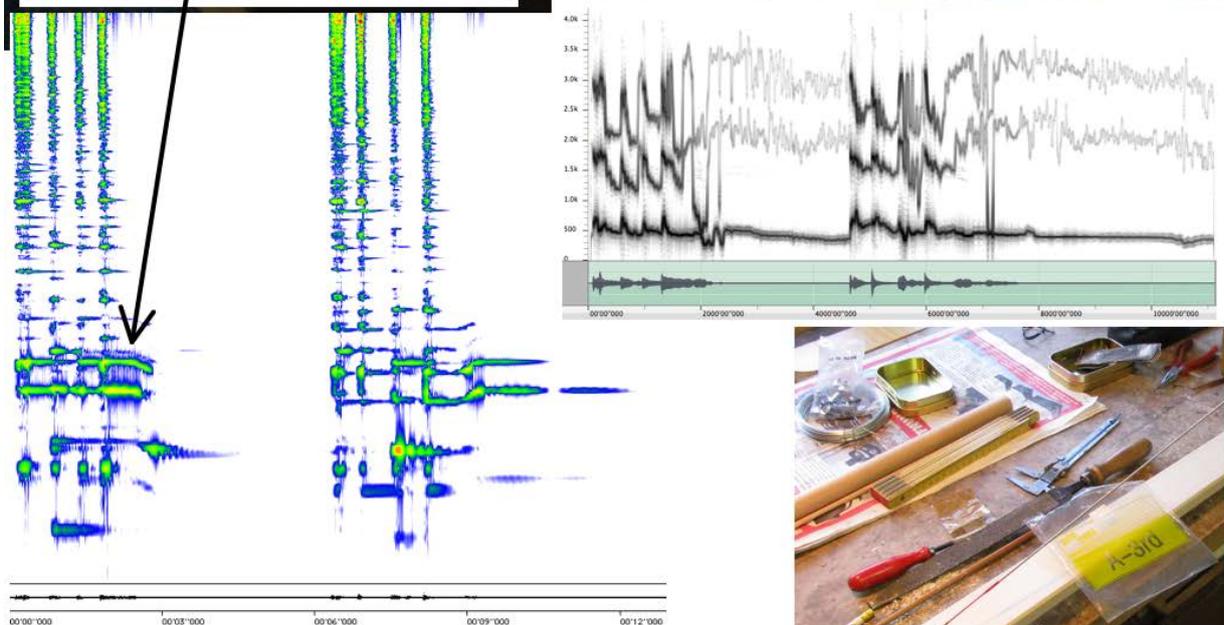
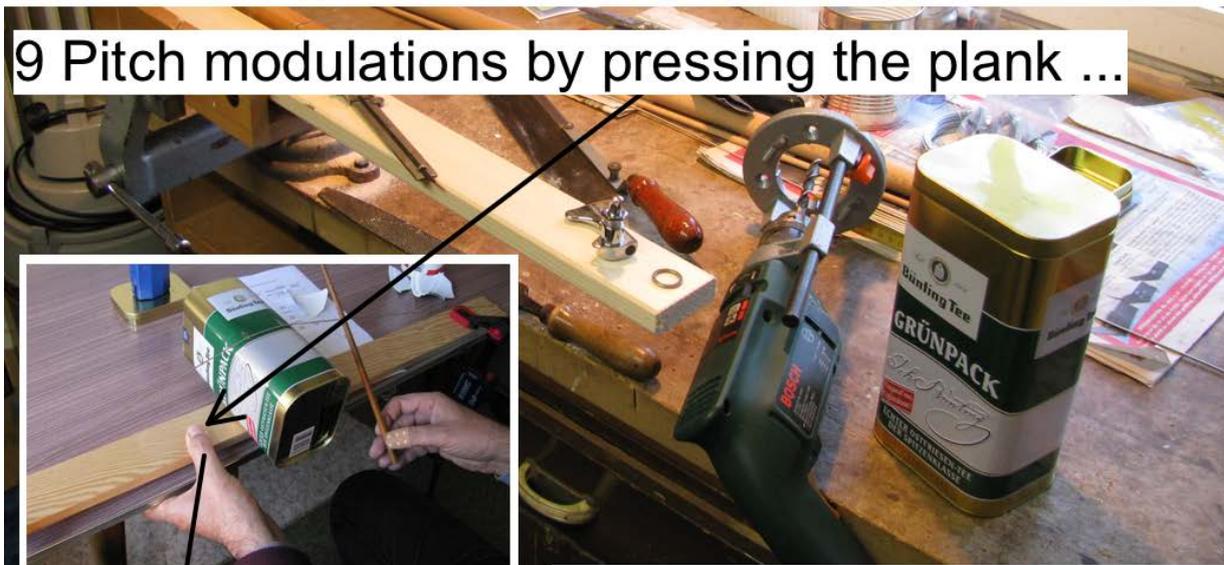


Fig. 9 © Manfred Bartmann 2017. Some photos © courtesy of Karl Bartmann 2015.

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Resume

As a branch of psychophysics, psychoacoustics is the exploration of the human perception of sound. As we listen to musics, or to any other sound, psychoacoustics will always have an effect on how we hear what we hear. Therefore, psychoacoustic findings, rules and nexus cannot be ignored let alone be switched off, neither knowingly nor willingly. So brace yourselves ! Psychoacoustics will always hack your ears, as it will rule your perception of any sound as soon as it has entered your ear.

Very similar acoustic stimuli, as displayed in sound images (here as spectrograms), may cause different auditory perceptions in individual listeners. On the other hand, different stimuli may have evoked very similar, almost identical auditory perceptions.

Listeners have verified the experience described above for the sound samples displayed in Fig. 1-5. It goes like this: Two listening strategies will always compete. You may concentrate on pitches, especially on pitch modulations, which requires one to hear more analytically. On the other hand, you also may concentrate on modulations of timbre, especially on formants, which requires a more holistic hearing.

On that note, I decided to rely on an algorithm which is probably similar to that one, the speech-like sounds of the famous R2-D2 may have been created, to help me offer a third listening strategy. These warbling sounds may help to question your perception of pitch and timbre and doing so, detect more of the details and subtleties. In one way or another, the sine-wave speech reminding one of R2-D2 turned out to be a great device when making music of speech, in these cases by extracting almost speech-like modulations from any musical signal.

According to the German philosopher Hans-Georg Gadamer (1900-2002) understanding could be defined as an art, in this case the art to allow someone to demonstrate subtle differences in sound quality. In these 9 cases understanding requires comparative listening, i.e. first to take notice of a characteristic sound and then straining one's ear to perceive modifications (Bartmann 2005).

See Bartmann 2005; CD Bartmann 2011; APP Boersma/ Weenink 2015; Dargie 1988; Graham 1994; Kirby 1953; Kubik 1999, 2001; Lawergren 1988; Rubin 1982; Rycroft 2001ab; Vogels 2012; Schöpf 2008.

Search keywords for Wikipedia: A/B testing, Ben Burtt, Formant, Fundamental frequency, Hans-Georg Gadamer, Harmonic_series_(music), Just-noticeable difference, Musical_bow, Perception, Pitch (music), Psychoacoustics, Psychophysics, R2-D2, Sinewave synthesis, Spectrogram.

Search keywords for YouTube: African Musical Bows, Audacity spectrogram, Fun Times with spectrograms, Introduction to Spectrogram Analysis, Johan Sundberg, Reading Spectrograms: Vowels, Step by step through a spectrogram, umqangala, Xhosa music.