

## 0. Tuning-in (... *not dropping out* ...) and getting into the groove

No - let's not (yet) talk about the rhythm-“groove”. This short pre-chapter is not supposed to correct the tuning of the guitar but to tune the reader to the called-for reading-groove ... tuning-in to electromechanical systems theory, to science – but also to fantastical blurbs.

Physics of the guitar – that is a wide subject (Too Far Afield, even?). There are non-linear differential equations, time-variant systems, non-homogeneous anisotropic materials, spinodal decompositions, diverging magnetic fields, and dispersive continuum-waves. Cast under a proliferating cloud of wafting catch phrases that could be not more dopey, bogus, fallacious and plain wrong. Undermined by self-proclaimed gurus who spam their unproven assumptions with steady regularity into magazine columns. Outshone by the infallible splendor of science that however prefers to bestow its affection onto those more noble instruments, preferring to ponder the violin, the pianoforte, and the church organ – rather than the armamentarium of Mr. James Marshall H. A science that will fastidiously check the spelling of the name of famous Lord John Rayleigh in order to at all cost avoid any mix-up with Sir Walter Raleigh, but is unable to distinguish between Jimi and Jimmy, just as it fails to get right the difference between rock and pop\*.

So ... yet another book about the electric guitar! That thing that the genius Segovia sought to deny the designation “musical instrument”. That guitar “wired for sound”, somehow operating with electrical current but still allegedly needing to “resonate” down into the very last wood-fiber after each plucking of a string. This here is not going to be easy – not for the author, not for the reader. Well then: if one does make an assertion regarding the effect of a shielding pickup cover, then supporting it with good reasons should be mandatory. Three purposeful reasons are: the physical/mathematical model, the results of measurements, and a correspondence of the two. However, a physical/mathematical model requires a certain basic knowledge in physics and mathematics – in fact that's an enormous understatement because in order to comprehend a coupling of modes, a good deal of specialist knowledge needs to be present. Therefore this book “Physics of the Electric Guitar” has not turned out as a book that will advise the musician which guitar to buy, but it is a documentation of years of research work. Still, since the author is not your regular theory-dweeb, either, but a practicing guitarist, the odd thought has made it directly from the left-hand part of the brain onto the paper, and remains comprehensible without any grand education in math or physics. Or so the author hopes, anyway! At least, these thoughts should not be any more cloudy than the allegation that alder would result in both fat and subtle bass, and in both accentuated and mushy articulation [guitar literature].

So: if you are not that much (or not at all) interested in formal-analytical description: do turn the page(s) ... more practically oriented passages and simplifying summaries always lie ahead. It is the guitar that remains the topic of this book, and not theory for its own sake. For the following pages, a few paragraphs from Chapters 7 and 8 shall be pulled ahead, to tune-in without a lot of math. After that, the (science-) band begins to play ... we're gonna get down to business.

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\* Memory hook for the gig: rock first, pop later!

## 0.1 Barking up some (wrong?) tree

Woodrow W. Worm, PhD, “Woody” to his friends, director of research at the guitar manufacturer Tawdro, has kindly invited us (my photographer and me) to join him on a hike as he inspects “his” woods; questions regarding wood in general, and regarding its sound specifically, may be asked. So: “Dr. Worm, Tawdro is a well-known...”

*“The globally operating guitar manufacturing enterprise Tawdro Inc. sells its world-renowned guitars across all continents\*.* We are a long-standing, tradition-minded business that has remained under company ownership for 150 years. Uh ... under family ownership ... I mean it’s owned ... it belongs to the Tawdrant family. They originally hail from the eastern parts of Germany and carried the name Drantow at the time. Carpenters by trade, they came to the Home of the Brave on the early 1800’s. Their original name was misspelled so often that it was changed to Tawdrant in the end.” “Aha! That’s the origin of the company name?”

*“Precisely. From Roland Tawdrant, venerable founder of the company. However, Rotawd would have sounded strange somehow. Hence: Tawdro.”*

“Understood! Still, Dr. Worm, for a guitar, doesn’t Tawdro somehow sound ... well ... there’s the association towards ‘tawdry’ ...”

*“I have no idea what you mean. In my dissertation about the third indo-germanic phonetic change, I have established clear proof that ....”* “There were no less than three of those?”

*“Of course not! That’s exactly what I provided proof for! About the name: in the 17<sup>th</sup> century, in the geographic East-German/Slawic context, ‘dran’ incidentally had a very different meaning that today would relate nicely to good guitars. The middle-high-German ‘trannck’ – mutating via the early-Franconian ‘trann’ into the later “tranig” – originated from the northeastern German ‘schtyrannckhaft’, as it was already shown in Mai 1956 by Nana Tucketti Slay-Ryde and Johans Begoud Toonite in their reference book: De Thri-Teimes Fone Tshanshe off Tschermanske-Indish ...”* “Please, Dr. Worm – we wanted to discuss wood...”

*“Oh yeah – right. These etymologic details will indeed concern only true specialists. In short: they often changed name like that back in the day. Just think about Son Gibbo, Martinus Frido Christophon, Peef Ehartla, or Fend Erleo, or Smitty ‘Rushes’ Paolo. Many company- and brand-names came about that today globally command respect. In fact, my work with ...”*

“The wood, Dr. Worm, the wood ....”

*“Of course. Wood is the fundamental ingredient of the guitar vibration. That is why it is THAT important, isn’t it? Without wood there is no vibration, no tone, no nothing, is there? Wood – that’s the heart to the guitar. Not just the heart – it’s the soul. But that’s impossible to convey to a technician. If a merchant offers me a batch of Honduras mahogany, I first smell into every chink and grasp the olfactory overall composition. That’s like it is with music, or – better – with wine! Your tongue has to shape up – you know what I mean? Oenophile?”*

“I’m more into beer ... so the wood determines the sound for the electric guitar, as well?”

*“Certainly! Without wood there is no sound, no guitar! I shall demonstrate this with ...”*

Abruptly, Dr. Worm’s elaborations are interrupted: a specific tree absorbs his attention completely and stops the lecture. Dr. Worm circles the tree, approaches it, walks away and back, extends his hands, raises them, lowers them. No, that is no sudden attack of Qi-Gong – we are privileged to witness a tree-claiming. Dr. Worm intones a slowly swelling vowel similar to an “ommmmm” but breaking off after a few seconds with a loud “aikkk”.

*“Ommmm-aikkk, ommmm-aikkk!”* Fascinating!

“Dr. Worm, sir, could you explain to us what ...” *“Silence – not now!”*

Obviously, a tree-claiming must not be disturbed. Quietly, we wait in the background so as not to again disrupt the events in such an unqualified fashion.

After several minutes, Dr. Worm disengages from the tree, approaches us and elucidates:

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\* Seminar for execs on marketing: “the first sentence is the most important one“.

"These force-fields – did you feel them, too? This will be true premium wood! Check the piles over here – that's it already drying." He picked up a few of the piled-up branches, smelled them, tapped his finger against them, and seemed to sense vibrations inaudible to us. "In about 40 to 50 years, when it is well seasoned and dried, use that to build an electric guitar – you will get a strong bass, loud low-mids, assertive high-mids, and a dominant treble."

"That is a most interesting and obviously typical example. Couldn't we also describe that kind of sound by "more of everything?"

"That would be highly unprofessional – no, the expert evaluates the bass, the low-mids, the high-mids, and the treble. In more detail: the lower bass range, the upper bass-range, the lower mids, the higher mids, the presence, the absence, the dominance, the brilliance and the articulation. 'More of everything' does not make for precision discrimination, does it?"

"But then, where is the distinction between 'strong bass, loud low-mids, assertive high-mids, and dominant treble'? If everything is loud, where is there something specific?"

"That is amateurish thinking. For my master thesis "About the Wood in general and the Sound in particular", I have done a literature search and worked through a multitude of books and magazines on electric guitars. Let us just take ash as it is deployed in Fender guitars, for example. Specialist literature describes its sound as:

**Ash**<sup>Ⓢ</sup>: mellow, rocking, soft, bass-y, brilliant, emphasis on the mids, no pronounced share of mids, balanced, lively, powerful, tight, warm bass, long sustain, dry, airy, hard-wood-y, rich in attack, strong assertiveness (because ash is of stiff structure), responds considerably faster than alder.

*Look, you have to be aware of all this if you want to build a guitar. Indeed, that is not a rush-job, no simple saw-&-glue-together, but its fine craftsmanship. Artisan craftwork, crafty artwork. Otherwise we wouldn't require those years of training and formation, those advanced olfactory and gustatory seminars of ongoing education ... "*

"Even gustatory??"

"Yes, sure – the lay-person is not aware of all that. Good guitar-wood needs to be grasped with all sensory channels. I do not only smell the wood – I taste it, as well."

"Really quite fascinating. But let's go back to your literature search, where you said: ash sounds both mellow and rocking. Isn't that a contradiction?"

"By no means! These are citations from different reference books! Of course only the expert is familiar with this so-called semantic differential. Von Bismarck is said to already ... "

"The battleship? The one that sunk the Hood?"

"... and was sunk itself shortly after ... so many lives lost on both sides ... tragedy ... where were we? No NOT THE SHIP! Von Bismarck was the chancellor of Prussia and then of Germany in the late 1800's, but I don't mean him ... a later Von Bismarck, there was a keen thinker in the family... The name slipped my mind. Gandalf maybe ... no, that would be Tolkien ... or Gottfried, or Gilbert ... or Sullivan ... no, that would be the composers. Maybe Gottfried, after all ... " "Dr. Worm, Sir, please ... the rocking ash ..."

"Sure, ash. Rock, that indeed does not always equate to just rock – there's hard-rock, soft-rock, prog-rock, under-the-rock, metal, death metal, beyond-death metal, grinch, grunge, grump, pump, hunk, and hulk!" "What – him, too??" "What do you mean: him too?"

"Does the Hulk have a special sound? I thought he's just green?"

"I don't understand what you mean. A "green" sound – our area of trade is not aware of that. But this is not uncommon at all in science! Especially in the interdisciplinary realm, close to the fringes, pushing the limits – you will find a lot of ignorance there. That's just why we have specialist literature that exactly specifies the sound of the wood."

<sup>Ⓢ</sup> Literature sources are given at the end of the chapter

"So: mellow-ly rocking?" *"That's for ash, of course."*

"But how do the assessments of "emphasis on the mids" and "no pronounced share of mids" fit together? Would it be possible that one of the expert authors is not that competent, after all? Or that the wood is not that decisive to the sound, anyway?"

*"No, of course not – wood is always decisive. One expert will write "emphasis on the mids", because he perceives the sound as such: with emphasized mids. The next expert will write "no pronounced share of mids" because he will perceive the mids as not pronounced. That is not a contradiction at all!*

"And that was discovered by that Bismarck person?"

*"Von Bismarck! ... Um, no ... well, yes, I think so. Or rather in parts, I think. The semantic differential differentiates the semantics. You yourself have asked about the differentiating aspect when I first elaborated! The differences in the semantics, in the teachings about the meaning of words. That's Von Bismarck – it seems he is even acknowledged by some psychological psycho-acousticians. And that is quite something! I'll only mention Berkeley. Have you already seen those guys?"*

"In Boston?"

*"Why in Boston? In Berkeley!"*

"Oh ... not Berklee but Berkeley!"

*"I see, you had those other people in mind. Here we have more of a phonetic differential. Did you know that already in the Middle Ages ..."*

"!!!"

*"Okay, right – the wood. Well then: if one type of wood sounds bassy, mid-emphasized, and trebly, then that's balanced, isn't it? And a long sustain may well sound dry. The opposite would be ... well, one would have to say ... opposed to dry sustain ... but ash does actually not show this kind of contrast. To the contrary, the mellowly-rocking, airy-balanced dry sustain is indeed a characteristic for ash. Contrary to alder, that is."*

"Oh – that's interesting. What characterizes alder, then? Does alder sound different compared to ash?"

Dr. Worm jerks to a halt, raises his right index finger and utters, almost in a whisper: *"alder is the perfect material for the electric guitar. Alder is the master builder's wood. If I had to build an electric guitar right now, alder would be my one choice. About alder, my literature search indicates:*

**Alder**<sup>Ⓢ</sup>: silky, mellow, warm, tender, many harmonics, restrained share of treble, fat bass, rather subdued share of bass, strong mids, round share of mids, much sustain, accentuated, squishy, good presence, undifferentiated, balanced, full sound, a sound thinner than that of basswood, faster response than basswood.

*That's how experts judge in specialist books. Now doesn't that sound very different compared to ash, after all! Knowing this, we can build a custom guitar for every customer as requested. Of course, only the expert knows this – wood is not understood by just anybody."*

"Indeed, Dr. Worm – we, too, have some difficulties to get it all straight in our heads. Fat, tender, subdued share of bass, and with squishy-ly accentuated presence yet being undifferentiatedly-balanced ... that Von Bismarck fellow is again behind this?"

*"Right, that later one. Yes. A most differentiating description, indeed."* "Really?? Excuse me, that is outlandish! How can one and the same wood sound squishy and accentuated? With a bass that at the same time is both tender and fat, and rather subdued on top of that! The reader will discount that as pure hokey-pokey!"

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<sup>Ⓢ</sup> Literature sources are given at the end of the chapter

*"Now, that does hurt me a bit! This criticism of centuries-old knowledge – that is not justified! These insights have helped for hundreds of years to build violins that to this day ..... and it will assist in all likelihood for hundreds more years!"*

For a moment, Woodrow W. Worm, PhD, is almost angered, abruptly turns around, takes a few steps ... but then stops again and elaborates in conciliatory tone: *"I understand now that you cannot understand this. Look, consider we have some luthier writing a book about the electric guitar. He will just be compelled to put in a chapter about wood, won't he? And since he will – like probably every luthier – at some point have heard an alder-Strat with its fat bass, he may well write that in his book. Don't you think so?"*

*"We start to understand. Another author will own an alder-Strat with more subdued bass ..."*

*"Presumably so. After all, we have – on a global scale – a large number of alder-Strats. Thousands. Millions, even! Still, not everyone having a Strat at hand should be allowed to write a book about it – isn't that true? Only the expert may do that, right? Because in books, pure opinions mutate into dogmas, into axioms, don't they? Specialist books are objectifications of subjective assessments."*

*"But if we now impute ... sorry: attribute ... such different – even opposite – characteristics to the wood, wouldn't it be better to say: the wood has practically no effect on the sound of an electric guitar? You will not want to publish contradictory doctrines in textbooks, will you?"*

*"Science does live on dispute, it subsists on the dialectic contention of diverging spheres."*

*"Wow! Whhhhaahht?"*

*"Wood is, after all, an object embracing objective characteristics ..."*

*"The soul ..."*

*"That is something you will never comprehend: it is exactly the soul that is not the objective but the transcendent, holistic mystical. No, I allude to the objective criteria that exist far beyond any validation. In the terms set out by Plato, I say: wood, as a spiritual universal essence, has an existence outside of human thought. Seen from that angle, the textbook author delivers his personal subjectivization of the objective. Do you follow?"*

*"We're trying: the textbook as coexistence of objectified subjectivity and subjectified objectivity. In a way: as platonic coexistence?"*

*"That's about right. Aristotle looked at it in a different manner, as did Hilbert, by the way – Fuchs elaborated on that already back in 1972: an accentuation of axiomatic contemplation implies that we keep – of the factual material of notion from which the basic concepts of a theory are formed – in the axiomatic design of the theory only that which is formulated as extract in the axioms, while abstracting from all other content. That's Knaur, in 1972."*

A clearing had come in sight, and Dr. Worm picks up the pace as he purposefully approaches a young basswood tree. His flow of speech had stalled – but only for a moment. *"I can exemplify that with this young lime, or basswood, tree. It represents a wood highly suitable for electric guitars – although it is underestimated by many. This lime tree here"* – he competently kicks the trunk, such that the whole universal essence is shaken by unbridled vibrations – *"has a very good response, as you can clearly recognize, but will give a squishy sound. That does, however, not imply that basswood will – in the sense of Plato – necessarily sound squishy always and everywhere. It does not even need to be called basswood at all: in Hilbert's terms it could also be designated table, chair, or beer mug. But let us by all means leave the name, let's continue to simply designate it 'basswood' – it is called that, after all. In my literature search, I have compiled everything at our disposal regarding basswood:*

**Basswood**<sup>Ⓢ</sup>: mellow, low mids, squishy, good response, undifferentiated, somewhat mid-laden, similar to alder, relatively little sustain, warm sound that lacks zappy-ness, unobtrusive, forceful, rather dull-sounding.

*I believe that the above three examples of ash, alder and basswood quite clearly show the effects of the wood, and what specialist literature is capable of.”*

"You are correct, our opinion on the matter starts to solidify. Alder with its accentuated-squishy, mid-emphasized, mellow-full tone is thinner in sound than the well-squishy-ly responding basswood with its soft-powerful low mids?"

*"In a very compressed fashion, yes. According to the textbooks: yes. Yes, by all means. To summarize even more succinctly: basswood sounds similar to alder; however, alder sounds thinner than basswood. More like poplar – which by the way sounds like basswood. I shall right away reveal the sound characteristics of other woods that are excellently suitable for electric guitars:*

**Poplar**<sup>Ⓢ</sup>: the tonal characteristics correspond to those of basswood, clear treble, more airy than basswood, unobtrusive, round sound, like basswood but thinner, the tonal characteristics correspond to those of alder but lack warmth and brilliance, more crisp than basswood, round tone, rather short sustain.

**Maple**<sup>Ⓢ</sup>: rich in attack, singing tone, hard sound, much sustain, rich in harmonics, lively, not warm, warm bass, lacking warmth, mid-emphasizing sound, brilliant.

**Mahogany**<sup>Ⓢ</sup>: mellow, very bass-y, delicate brilliance, warm mids, good sustain, silky, warm sound.

**Rosewood**<sup>Ⓢ</sup>: powerful and harmonic sound, airy basic character, loose and full bass range, sparkling treble.

*Let's hang on to this fact: the wood defines the sound of the electric guitar. The – I am tempted to say: new-fangled – electronics can only add nuances! The basic tone is generated by the wood.”*

"Indeed, we have also already seen this opinion. A well-respected author writes in 1977 A.D.: 'every piece of wood has its intrinsic sound'. A few pages on, the same author opines (in the same book): 'the sound of an electric guitar depends mainly on the pickup', and in 1994, he proclaims in a new edition: 'for solid-body guitars, as well, the body has a decisive influence on the sound'. In the same new edition, we again read a few pages later: to a large part, the difference in sound between electric guitars is due to the pickups'. So there we have it again, what the (original) elders already knew: all things are connected ... everything depends on everything else. What is more important, though: pickup or wood?"

*"In my literature search I have looked into this issue, as well. The thing is: for the luthier who knows everything about wood but has had no course on electro-acoustics, the sound of the electric guitar is in the wood. However, those who have graduated in physics or electrical engineering but cannot tell a board of beach wood from swamp ash, nor from birch – to those the sound is exclusively due to the pickup. See the following literature collection:“*

<sup>Ⓢ</sup> Literature sources are given at the end of the chapter

- ◆ Wood does not influence the sound (Pearson/Webster, in: May p.144).
- ◆ Wood must have an influence, differences in pricing between guitars are due to the wood (May, S.144).
- ◆ Using high-grade wood is futile (Zills, in: May, p.86).
- ◆ Wood has an influence on the sound (Evans/Evans, in: May, p.145).
- ◆ The influence of the wood on the sound must not be underestimated (Gitarre & Bass, 3/97).
- ◆ Experts agree that the sound of a solid-body is mainly determined by the electronics (Carlos Juan, Fachblatt Musikmagazin, 1996).
- ◆ The sound of an electric guitar depends relatively strongly on the wood (Meinel, p.47).
- ◆ The sound is not mainly determined by the pickup; rather, the wood provides the foundation (Jimmy Koerting, Fachblatt Musikmagazin).
- ◆ Pickups convert the vibrations they are subjected to and do not form the sound themselves (G&B 5/06).
- ◆ The tonal characteristic of the electric guitar is substantially determined by the choice in the wood. Pickups and amplifiers support the sound of the guitar but rarely change, influence, or mould it fundamentally (Day et al., p.205).
- ◆ Solid guitars can, however, be manufactured in almost any shape and size; no considerable effects on the sound should be expected by this. (Day et al., p.140. That's the same Day as in the previous citation).
- ◆ The wood does not only determine the sound color but in particular the information of the string vibration (Gitarre & Bass, 02/00).
- ◆ The electrified plank-guitar is predominantly an acoustic instrument. The wood determines the sonic character; the pickups only to a very small extent. Hence a humbucker is nowhere near to be able to exorcise the characteristic sound- and attack-evolvment from a Strat with alder- or ash-body (Udo Klinkhammer, Gitarre & Bass, 2/00).
- ◆ Looking at the process of the sound generation of the electric guitar, we quickly grasp that the quality and type of the wood used will influence the sound of an instrument just as massively as the construction (Day et al., p.206).

*"Now that is a clear vote: the majority sees the wood of an electric guitar as determining the sound. If that were not the case, we could build great-sounding guitars just as well from inexpensive materials. Which is not what the specialist trade can be interested in. Or at the most there is a supplementary interest. That's why every brand manufacturer points out that they have only the most expensive tone-woods underneath their sunburst finishes. And that, my friend, easily necessitates to a price of one or two grand. Dr. Worm again kicks against the trunk of the basswood, as if to underline his words: the products issued by his company were indeed also looking for recognition and intrinsic value – and therefore for high retail prices. From the tree, a butterfly that had been disturbed due to the rather massive tremor in "its" bass wood took off, zappily got off the starting blocks, resonated all the way to the wingtips but then landed again with an undifferentiated, squishy decay in its wing motions. Relatively little sustain – the thought flashed through us.*

"But, Dr. Worm, Sir – may we call you Woody? – if now the professional circles report so inconsistently about the wood: hasn't anybody compared guitars made of different types of wood? If ash and poplar sound so differently: couldn't we just compare an ash-Strat with a poplar-Strat?"

*"Woody it is, then ... indeed that has been done, as e.g. the report in the Fender-issue of G & B shows. However, this listening comparison yielded only 'minute differences'. Could be both an individual opinion and verified expert knowledge. But there are more comparison tests ..."*

Dr. Worm – Woody – had stopped because from afar a buzzing engine noise had become audible. “*They’re sawing away again*”, he said with disgusted air. “*For building-timber.*” The direction from which the noises could be heard seemed to unsettle him. It was the direction of where we had started our educational forest-walk. With a short “*I gotta see that*” he turned and started back on our path, almost running. His facial expression vetoed any further question. Time dragged on, minutes passed – only now we became aware that we had walked downhill for some distance, and now it was an uphill rush towards the buzzing noises of the saw (increasing from a perceived 0.2 Asper to now 0.4 Asper). A smokey-tar-y component suddenly attacked our olfactory afference, still undifferentiated but quickly gaining in dominance. While the information of the n. opticus by itself could have been interpreted as a kind of fog, the cooperation of first and second brain nerves clearly indicated: something’s burning! Forest workers became outlined against the smoke, force fields diverged ... we had been here before? In the center of the scene: the ash tree, the wood for the master craftsman (at least in 40 to 50 years). Right in the midst of it, but less upright and less proud than it had been only an hour ago, rather cut up into sub-sets now, still unsorted, lying around on the ground in bundles. The thinner ones of the master-woods branches, previously piled up to dry, they had been thrown together forming a heap, flames flickering already, affording warmth to those hands that only minutes before had callously decapitated the wooden bretheren. Ash to ashes ... Benef’cent is the might of the flame, when o’er it man doth watch, doth tame. Woody lost it completely, enraged, beserk, his balanced round bass gone with the wind, rich in attack he went up against one of the lumberjacks, with his treble content having lost any moderation: “*You can’t do that! That was wood for the masters!*” “*That’s how us here’ve always been doin’ it*” – strong mids came back from one of the workmen. “*We cold, we light ’em up*”, his neighbor contributed with resonant bass, and a more trebly but still squishy voice added: “*la leña seca bien arde, amigo!*”

We decided to better not get involved in this final dispute, as much as it might have been of scientifically fundamental and typical character. We pondered the rising smoke. Lively-powerful, the grey curled out of the glow, converted into white, pulling a Fibonacci-sequence-like bifurcation right behind it, just before it dissolved itself, rapidly ascending to a higher plane. The warm fundament grabbed us with its tight bass, while it dive-attacked from above with distinct hard-woodiness. No doubt at all: it had to be ash – that much we had learned from the elaborations of Woodrow ‘Woody’ Worm, PhD. Ash through the ashes ...

And some supplementary opinions<sup>1</sup>:

G&B (Gitarre & Bass), 9/02, p.80: “*Bob Benedetto, whom many (practically all) take to be the best luthier alive, states: popular opinion demands wood that has slowly grown (slow growth shows in narrow tree rings). According to my knowledge, that is a myth. ... some of my best guitars are made from spruce that some would take as substandard. Check out the old masterpieces from Stradivari or Guaneri – they are made from wood with wide tree rings, as well. Maybe we have, for years, fallen for the advertisement in the brochures of a few companies that promote wood with narrow grain. ... Once I went to a wood supplier in Pennsylvania and bought the worst wood I could find. I built a guitar from it that sounds excellent – after all, Scott Chinery bought it.*”

Tom Lockwood, **Guild-Guitars**, in: U. May, p.145: “*Manufacturers like ourselves only use the highest-grade material, that’s only about 5% of the yield. We therefore ask a mill producing 100.000 board feet to let us select about 5000 feet. The remainder we have no use for, and that has a tremendous impact on the price.*”

<sup>1</sup> Translator's note: the citations were in German and I could not trace the originals in English (where appropriate). I therefore re-translated them into English. This will without doubt have led to a different wording compared to the original. The same generally applies to citations throughout this book.



“**Taylor** builds good guitars because we now how to do it. To prove that, we have built an acoustic guitar from an old, rotten pallet we found in the garbage. The top was from a scrapped plank of which we could not really determine the wood. We so elaborately glued together the top from 6 slats that it is hard to even detect that, and the holes from the nails ... were highlighted with small aluminum discs. This pallet-guitar was one of the most noticed guitars at the winter-NAMM-show (Bob Taylor, ISBN 3-932275-80-2).

"Besides, I actually think that the component wood is, in general, overrated" Ulrich **Teuffel**, Teuffel-Gitarren, in G&B, 5/04, p.85.

**D. Holz:** Holztechnologie 25/1, 1984, p. 31-36: about some correspondences between forestal-biological and acoustical characteristics of tone-wood (resonance wood): “A connection between the year rings and the acoustically important properties of resonance woods cannot be specified.” G. **Ziegenhals** on the topic: "Recent investigations at the Inst. for Musical Instrument Making" generally support this." FAMA-Seminar, DEGA 2001.

- ◆ The Les Paul Custom sports an **ebony fingerboard**. An ebony fingerboard gives a slightly more mid-rangy sound (Luthier Thomas Kortmann, gitarrist.net).
- ◆ An **ebony fingerboard** results in a brighter and more brilliant sound (Gerken).
- ◆ A fingerboard made of **Rio-rosewood** will render the sound more brilliant. (Kortmann, gitarrist.net).
- ◆ The **maple fingerboard** makes for the clearer sound; the rosewood fingerboard will sound meatier. [Duchossoir, Stratocaster-Book].
- ◆ **Rio-rosewood** produces a ‘full octave of additional harmonics’ (Day et al.)
- ◆ For me, **maple fingerboards** work much better than the ones made from rosewood because they have a tighter, stronger tone (Eric Johnson, G&B, special Fender issue).
- ◆ The "Slab-Board" (**rosewood fingerboard**) is one of the secrets of the renowned old crystal clear vintage-sound especially in Fender guitars (Day/Rebellius, p.72).
- ◆ Electric guitars with a **neck-through** construction behave much more favorably compared to a bolt-on neck. The gain in sustain is striking. (Meinel, 1987, p.63).
- ◆ Set neck and bolt-on **neck** have equivalent decay times. (G&B, 3/97).
- ◆ The **bolt-on neck** diminishes the sustain of the guitar (Lemme 1982, p.59).
- ◆ The bolt-on **neck** can generate a long sustain, as well. (Lemme 1994, p.50).
- ◆ Overall, **maple necks** are known for giving the instrument a percussive touch (G&B 4/06).
- ◆ One-piece maple necks sound just like necks *with* glued-on fretboard (Lemme 1982, p.62).
- ◆ (There are) practically no differences between three special guitars that are distinct only in the way the neck is attached (glued-on, bolt-on, neck-through) (A. Paté, Nantes 2012).
  
- ◆ The **maple** top contributes a lot to the sound character of the Les Paul (Gibson-CEO Henry Juskievicz, in: Bacon/Day, Les Paul Book, p.61).
- ◆ The Les Paul Customs had a body completely made from **mahogany**, just like Les Paul preferred it to the mix of maple and mahogany. (Bacon/Day, Les Paul Book, p.20).
- ◆ G&B, 9/05: **Les Paul**: back then my idea was to manufacture the whole guitar, i.e headstock, neck, and body, from one and the same piece of wood. They didn't do it. When I asked the president of Gibson why not, he replied: “because now it's less expensive.”
- ◆ G&B, 7/02, comparison test: "The Fame LP-IV indeed sound most authentic. Its sound is very similar to that of the original (Gibson Les Paul).”
- ◆ **Fame LP-IV**: maple neck, oak fingerboard, alder body, mahogany top.
- ◆ **Gibson Les Paul**: mahogany neck, rosewood fingerboard, mahogany body, maple top.
- ◆ G&B Fender special issue S.76: **ash**-Strat vs. **poplar**-Strat: only 'minute differences'.
- ◆ G&B 10/04: **alder**-Strat vs. **poplar**-Strat: differ only in 'finest nuances'.
- ◆ Of course, the **body wood** decisively shapes the Fender sound. ... A true connoisseur hears totally different characteristics in a 61 Strat compared to a late 64.

*A few paragraphs on, we then read in the same (!) comparison test: as one will imagine, the sound results are very close to each other (G&B 3/06).*

- ◆ G&B 5/06: Squier-**mahogany**-Strat vs. Squier-**basswood**-Strat: using the neck- or middle-pickup the two guitars sound all but identical.
- ◆ G&B 9/05: Still, the PRS EG surprises with authentic Strat-sounds (mahogany neck, rosewood fingerboard, mahogany body).
- ◆ G&B 2/00: Despite the **humbucker**, a Strat can never become a Les Paul.
- ◆ G&B 7/06: **Gary Moore**: some people believe that you hear a Stratocaster on 'Ain't nobody', but in reality it's my own signature Les Paul.
- ◆ **Jimmy Page** recorded the complete first Led Zeppelin album using a Telecaster. The guitar sound on that album is exactly that of a Les Paul. (G&B Fender special issue).
- ◆ G&B 9/05: and so despite identical basis (mahogany neck, rosewood fingerboard, mahogany body) the three PRS-SE guitars each deliver typical sound characteristics à la Strat, SG/LP-Special, and Standard Paula, respectively, and this on a high sonic level.
- ◆ **E. van Halen**: "Die Strat had too little sustain. Hence mahogany" (G&B 7/04).
- ◆ **Larry Carlton**: "The Tele doesn't kick butt sufficiently. Hence Gibson" (G&B 5/01).
  
- ◆ **Cavities** (in the solid body) have no influence on the sound (Lemme 1982, p.54).
- ◆ "To improve the body's resonance, the core body is drilled with eleven 1,5"Ø cavities." (Duchossoir, Tele-Book, p.31).
- ◆ "The cavities in the Les Paul have no influence on the sound characteristic of the model; we tested it. (Henry Juskiewicz, Gibson CEO, Les Paul Book, p.61).
- ◆ "Cavities increase the ability to resonate." (Day et al., p.140).
- ◆ Resonance chambers: "It is difficult to avoid the impression that the router was called in often, and wood was taken away until the manufacturer was of the opinion that now the guitar is light enough" (Day et al., p.143).

**Eric Johnson**: "More than 75% of the sound is in the fingers". (G&B 5/01).

**E. van Halen**: "It's not really the equipment, it's in the fingers". (G&B 7/04).

**Jimmy Page**: "You know, I'm getting a lot of sounds out of that guitar that you will normally not get from it." (G&B Fender special issue).

**Richie Sambora**: "But you also hear that Hendrix went through only through the amp. It's his fingers. The same with **Jeff Beck**: you may use his rig and his guitar but you will never sound like him. It's in the fingers." (G&B 11/02).

**Jan Akkerman**: " It all comes down to your hands." (G&B, 1/07).

**Jaco Pastorius**: "Piss off the amp and the instrument. It's all in your hands." (G&B 1/06).

**Jeff Beck**: "no shenanigans, no mumbo-jumbo – just the fingers." The man does get it right ...

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## 0.2 Signature guitars

To have a signature guitar built by a well-known company – for a guitarist, that is like being knighted. There's fame, the records are selling in the millions, and now the maker of that be-all-and-end-all go-to guitar asks whether one's name can be put on the headstock. And so Tawdro releases a Paco-Beslmeisl-guitar, and presents it to him with maximum ballyhoo at the SchlockMuCom. Such special edition models are usually developed in close cooperation with the correspondingly honored guitar player, and address all those who seek to sound just like their revered idol. A genuine Paco-Beslmeisl-Signature – only the dyed-in-the-wool fan owns that. Complete with yellow pick and a bandana.

The corresponding actual genesis, however, may be rather sobering: "Oh man! Look, Henry, the October numbers are not really up to plan – got an idea?" "Let's do another signature, then." "Yeah, that's what I thought of, too. Whom could we choose?" "Whom ... well ... that so-called manager of that WARLORD guy just mailed about when at last he'll get one. His present axe is a shambles." "WARLORD – that douche should first bring back the rig we loaned him and that allegedly is now in an ebay-auction the third time already. That guy – we will at the most supply him with a lid on his coffin – in company colors." "Jeez – you ARE having a bad day; it was just an idea! I kinda dig the WARLORD – he's not as grotty as people always say. What about ol' BLIND BOOBY BROONZY?" "You crazy? Nobody gives a sh.. about him anymore. I was rather thinking of SLOWHEAD." "Right back atcha: that jackass these days resells his guitars right away; he's a no-go. What about BIERMEISTER?" "Not notorious enough here in the States. We should stick to one of ours. Or a Brit. No, rather not – they're tough to understand. Texas, that would be good – 'Don't mess with Texas' 'n' all'. Yeah – I wanted to visit Austin again, anyway." "Speak about Austin: what are HEALEY AND THE DIFFERENCE up to these day?" "Told ya: no Brits, and certainly not that underpowered HEALEY! Power we need, so maybe JOE ROCKER. His *Strings from Hell* sells like hot cakes at the moment. Right: JOE ROCKER, that would be it." "What? That guy is gonna kick the bucket any minute now. He was constantly high on heavy stuff and wouldn't come down ... now he's in intensive care. In AXXES, Lix 'n' Trix they already published a kind of obituary." "Awright!! That's it, then! Think about it: if he makes it, we present him his signature at the next WAMM. If he doesn't we issue it at the time of the funeral. Posthumously, sort of, in a black gigbag adorned with a silver cross." "We could also bring it to the IC room right now. That would make for an epic pic: ROCKER with his eyes half closed, mouth hanging open – and our signature axe right across the bed. I could hold it in place ... we'll want to avoid a disaster like the one at Ronnie's rehab last year when the guitar slid off the covers and crashed." "Done! Go call the head physician for a permission of the shoot and such – we'll pay him a flight to Vegas with two weeks in a suite ... they always have some kind of conference there, anyway. I'll inform the custom shop. At last they can use up the birch slats from Patagonia; those were going to be woodworm fodder soon." "Should I offer the chief physician some sweetening if he gets difficult – maybe a complimentary ticket for his wife, as well?" "Get real, man – why would he want to take his wife?! He's looking at a voucher for the all-inclusive package, and I mean FULL inclusive." "Okey dokey; well just need the text for the official statement, then. Something like: in every clear minute ... well: in every free minute, JOE has contributed to the design and development because he insisted that his sound comes across at 100% in this signature. He brought us his original axe to measure it, and by his own hand wound another 25 feet of wire onto the pickups. Even the barf-green – he designed it himself. What a hoot!! That makes signature model number ... ????" "Must be the twenty-fifth or so, I think." "Very well: **LIMITED EDITION!**"

Signature models carry the names of famous guitarists, and are designed in close cooperation with these. Say the ads, and say the test reports. And many an epigone buys such a special model, hoping that now he/she will be able to get the same sound as the hero. The latter will present just that same model to the camera, and will play the instrument exclusively, live and in the studio. Will he, really? Now, many of the top players own not one but 10 or 50 or even 200 (or more!) guitars. Will they suddenly play only that signature model?? The specialist literature knows more:

**Jeff Beck's** Fender-Signature-model is already marketed in a second edition. He himself (as stated by G&B) "uses almost exclusively just a regular Fender Stratocaster (only the tailpiece and the nut are taken from his Signature model)". Regarding his album "Blow by Blow", on the cover of which he is shown with a Gibson Les Paul, he says: "*because of that cover, many people believe that they hear a Gibson guitar on that album. It was Strats and Teles, though.*" (G&B, 2/01). Conversely, the Gibson book states: "For the recordings of this LP (meant is "Blow by Blow"), Jeff Beck used this guitar (meant is a brown Les Paul) almost exclusively – even though a Fender Telecaster with humbuckers can be heard here and there, as well. On some of the tracks, Beck started to use a Fender Stratocaster, and since then has been as good as married to that guitar and that manufacturer".

**Jimmy Page** "is known predominantly as a Les-Paul-player. However, he recorded all of the first Led Zeppelin album using a Telecaster (!) that Jeff Beck had given him. Replying to a remark that the guitar sound on that album was exactly that of a Les Paul, Page once told the interviewer from *Guitar Player*: "You know, I can get many sounds out of the guitar that you would normally not get from it. That confusion goes back to the early sessions that I played a Les Paul on. Those recordings may not sound like a Les Paul but I did use one." G&B Fender special, p.37.

Moreover, Messrs. guitarists the will be happy to switch the supplier. Here's **Richie Sambora** in an interview by G&B (10/02): "*Also, I am lucky to have a few 59's and a '60s sunburst Les Paul. Those are my favorites right now. As such, Fender has been marginalized a bit.*" G&B: "But didn't they recently make a signature model for you?" Sambora: "*True! But what can I do (laughs). ... Actually, I play everything that I get my hands on and that sounds halfway decent.*" Right above the headline '**Richie Sambora Standard Stratocaster**', we find in the Fender brochure: "Designed under the direct supervision of some of the world's most influential players, these models have been painstakingly crafted to accommodate each artist's unique specifications and playing style" (Fender-Frontline).

Duchossoir's book on the Strat, preface by **E. Clapton**: "The Stratocaster is about as close to being perfect as any electric guitar can be". Clapton-ad: "The one and only electric guitar\*." On the other hand, we read in Bacon/Day: "*I have never found a guitar quite as good as that one*" – with Clapton referring his lost Gibson Les Paul. Why should I care about what I said yesterday?! 'The Gibson' cites Clapton using an ES-5, the 'Cream sound' is due to Clapton's SG, or to his Firebird, or to his 335, respectively, and he famously used a Telecaster, as well. The acoustic-sound of Cream, however, stems from the Epiphone and Guild guitars of Mr. Eric Patrick Clapp. It seems many more signature models will be in order. There is already one issued by Martin ... that apparently was scorned by E.C. for his UNPLUGGED oeuvre.

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\* Stratocaster, G&B 4/06

**Mark Knopfler:** *"If I want a fatter sound, I'll use my Les Paul – it is simply more dynamic. That does not mean, however, that I could not do the same thing with a Stratocaster<sup>1</sup>."* That might not entirely reassure the gentlemen at Fender, since they write about the Mark-Knopfler-Stratocaster in the brochure: "His unmistakable tone comes from three Texas Special single-coil pickups and a five-way switch." And Mark even goes one better: *"Sometime I use the Les Paul to get a particularly clean sound<sup>1</sup>."*

Gibson's Lucille is **B. B. King's** signature guitar. Charles Dennis, guitarist in B.B.'s band, comments: *"We were out there somewhere and Lucille couldn't make it – she was still on the plane. We had to play the job, though, and he played a Fender. What can I say: in his hands it still sounded just like Lucille<sup>2</sup>."*

**Yngwie Malmsteen** has been given a signature model by Fender, but remarks: *"But the only ones that I actually play, are Strats from the late 60's and early 70's"*, (G&B 11/02, S.63)."

"Our desire with the whole Signature Series was to build the guitars exactly the way the artists play them. We didn't just want to build something that everybody was going to buy and then the artist had to have his different". Fender-exec Dan Smith in Duchossoir's Telecaster book.

**Lenny Kravitz** got a signature Flying V from Gibson. However: *"I can hardly remember the details. I don't now anymore what I changed on it – just that I shortened the neck some."* True, as the test report in G&B discloses: the scale is 625 mm, compared to the 626 mm on the original Flying V. Also: *"It is much lighter."* True, as well: 3.2 kg compared to 3.3 kg. *"And it sounds better. That makes a big difference."* The tester does indeed state that there is a difference: "To my surprise, it delivered more sustain than first expected, but it cannot match the regular V. In terms of attack and the evolution of the tone, it lags behind." What! The tester does some straight talking? That's is rather unusual ... he even detects a constructional flaw: "Due to the shallow neck angle, the strings can exert next to no pressure on the bridge; they run across it almost without any bend angle. One consequence is an unintended and annoying sitar-effect on the e-string". That, on the other hand, the vibrato is a weak point, that is typical: "the Maestro-Vibrato has always had the deficiency that it is not adjustable – neither in terms of the spring-tension nor regarding the height of string retainer. On the guitar under test, the lever hovers so closely above the pickguard that it is just about possible to get the finger under the handle." Still, Mr. Kravitz heartily condones the fact that the signature model sets the customer back a cool € 6990.-, in contrast to the regular model at € 2190. *"Such things are always more expensive ... (grin),"* Does he actually play it? *"In the studio I always use a selection of Les Pauls. Mostly goldtops or vintage flames from '58, '59 or '60"*. Typical stuff you will just simply use if you *"store about 140 guitars in a storage area specially rented for the purpose."* ... getting a signature guitar as no. 141<sup>3</sup>. Having said that: the Flying V seems not to be a total loss, after all: Mr. Kravitz poses in the bathtub with such a piece. Watch out, though, dear fans: that is the white V. The black V *"I would have never subjected to the paint"*. Because (aren't our artists so precious?!): the tub is not filled with water but with red paint. The situation became rather dangerous for **Kurt Cobain**: "He played Jazzmaster- and Mustang-guitars – until he received a signature model. He committed suicide in 1994<sup>1</sup>." Come to think of ... maybe ... had he stayed with the regular stuff ....

<sup>1</sup> G&B Fender special issue.

<sup>2</sup> G&B 9/06

<sup>3</sup> G&B 06/2004 p.72, G&B Gibson special issue p.126.

**Mike Einziger** (Incubus): *"For a long time already I had no fun playing the PRS. I just wanted something new. I wanted to change, without any sanction. And so I decided that I never again would legally tie myself in such a way to a guitar company."* Is that the reason why there is so far no signature model for Mike Einziger? *"Correct. I have no interest in that. To be honest, I find that simply silly ... (laughs). I mean, what should I change in an instrument that in its own ways is already perfect?"* G&B, 1/07, p.48.

... and many more ...

The specialist magazines further fuel the signature- and custom-market by detailed reports on how the great guitar-wizard has had his (or her) axe and amp modified. Frequently with the hint attached: "if you want to do the same, be prepared to shell out € 8000.-." Many an epigone will save over the years to reach this (or a smaller) number to come closer to his/her hero. And if the original Blackie is out of reach, then at least let's go for a set of 3 new pots for € 600.-. Or – for the Marshall – let's get that more authentic (!) output transformer from the US. The old lag over there is not even able to send to Old Europe an offer that would correspond to mercantile convention, but he does have, no less, several transformer variants in his self-wound assortment. Better sound? Only if you believe (Chapter 10.6).

For the sake of fairness, we do need to cover another variant: there's the well-off forty- or fifty-something who gets onstage with his mates on the weekend purely for fun. He really enjoys that they all envy him for his original 1963-Rickenbacker. He doesn't mind that it was expensive; to the contrary: that's why he bought it. And of course because the old Beatles songs are a pleasure to play on it. Actually, if such a Ricky could be had for € 100.- at every yard sale, he would have rather chosen the old Epiphone Casino. Or some other pricey 'unique feature'. Just like his wheels, a tuned up Helby-S Corba – that cannot be found on every street corner, either. Without any malice now: making music has got a lot to do with emotions. Including the audience ("incredible, a 'Rickenbacker'"), and the artist ("how can that bloke next to me coax such awesome tones from his el-cheapo?"). Therefore it is not uncommon – actually it is even imperative – that many musicians attribute a power of inspiration to their instruments that cannot be verified scientifically. Looking at that translucent-blue stained maple top ... oh man! On the rear, a tiny sticker becomes visible with a 4-four-digit figure starting with a 9 ... that's how impulsive comfort shopping happens (especially if GAS – gear acquisition syndrome – plays a role, as well). Finally: a 12-string that not everybody has. Didn't that one player back in the day – what was his name ... he must have played one like that or something similar ... man, these rare stringed bodies can get to you ... it's so ... oh ... where were we? Which chapter was this supposed to be? Ah, yes, right, special models! Custom-Shop, Artist-Gallery, Signature-Model ... of course! And why not? Not due to any logic and rationale! Not because of any alleged extra-fidgeting and some supplementary wisdom of some trendy idol, but out of pure lust and passion. Right - that had to be said! Sure, the sales guys are perfectly aware of this, and every year they provide ample ordnance for the passionate buyer with the bursting wallet: model of the year, limited edition, custom colors, custom woods, with the original signature by Mr. X (surcharge is \$ 4000.- with no less than about \$ 5.- going to endangered jungles), and of course the original 2<sup>nd</sup>-hand gear used by the big stars. That will be seven digits, then, for the particularly well-endowed money-bag. No joke at all. Seven digits – that's \$ and €, not Yen.

"Any lively joy is, too, a fallacy, a vapor, because no fulfilled desire can yield persisting satisfaction. Because, too, any possession and any happiness is merely on loan from chance for an undetermined time." That would be Schopenhauer. Probably wasn't a guitar player.

### 0.3 How the vibrations of the strings arrived in the Orkus

There's scarcely any test-report on guitars that does not praise the exorbitant vibration-propensity of the investigated electric guitar: "the design shows considerable resonance properties; after each string attack it vibrates intensely and clearly noticeably" [G&B 9/06]. Or: "From a vibration point-of-view, the MTM1 ranks at the highest level, since the whole structure resonates intensely into the last wood fiber after each string attack, resulting in a slow and continuously decaying sustain" [G&B 8/06]. Or: "Combined with the given open freedom of vibration, we arrive at a brilliant sonic image" [G&B 8/06]. Or: "Less mass can be more easily be made to vibrate" [Luthier Thomas Kortmann, Gitarrist.net]. Or: "At Fender they even proceeded to build the bodies from several pieces of wood. ... Of course, the ability of the wood to resonate will be reduced by such a number of pieces varying in size, as well". Und o.a.: "At the time, the fact that ash also has almost optimal resonance characteristics was noted with appreciation. It doesn't even bear contemplating what had happened if, back in the day, Leo Fender had opted for mahogany" [Day et al]. Or: "Clearly noticeable, both Strat and Tele show very good resonance properties right to the outermost wood fibers" [G&B 4/06].

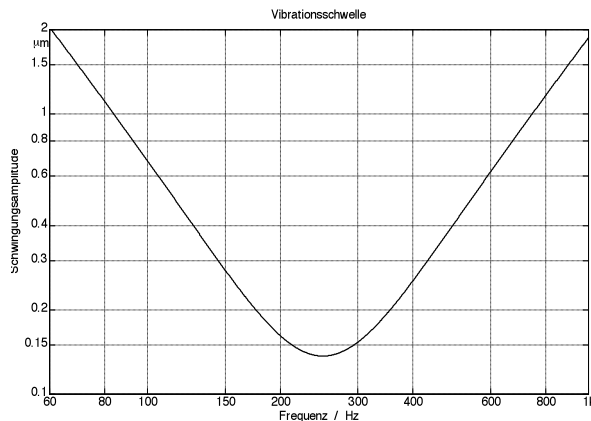
Take note: this is about solid body electric guitars, and not about acoustic guitars. The clearly noticeable **vibration of the guitar** is taken as a criterion for quality. Let's have the father of the solid body, Lester William Polfuss, have a word here: *"I figured out that when you've got the top vibrating and a string vibrating, you've got a conflict. One of them has got to stop and it can't be the string, because that's making the sound."* Mr. Polfuss wanted only the string to vibrate, and not the top of the guitar. Well, one could object that the man was a musician and not an engineer. Still, he was a musician who, answering the question about who in fact had designed the Gibson Les Paul, said: *"I designed it all by myself"*. The string is supposed to vibrate, and the body is supposed to keep quiet. Only the overly pedantic will interject here that in fact it is the relative movement that counts, i.e. if the string remains in rest, the body could instead ... no, enough about the theories of relativity; it works better the other way 'round. But then, what does "better" mean? What characterizes the better sounding guitar? In his dissertation [16], Ulrich May cites D. Brosnac who realizes that a guitar made of **rubber** would absorb all string energy within a short amount of time, i.e. it would not sound right. This is easily understood but does not prove whether ash, or maple, etc. are better suited. Obviously there are unsuitable body materials that withdraw quite a lot of vibration energy from the string. Rubber would be one of them. But who would want to build a guitar from rubber? Presumably, dough for steamed bread would be unsuitable, as well\*. For another approach, fresh from the sleep clinic: a bed of a length of 1.45 m (4.75 ft) is uncomfortable for most grown-ups, therefore a bed with 2.12 m (6.95 ft) must be more comfortable than a bed of 2.05 m (6.72 ft). To be more specific to our field: what the luthier has learned with respect to the acoustic guitar cannot be wrong for the electric guitar. A guitar needs to vibrate. Right into the outermost wood fiber. Intensely and clearly noticeable.

So, what in fact is noticeable, or perceivable, for the human in general and for the guitar tester in particular? That of course will depend on the stimulus and the receptor – but regarding vibration, the subcutaneous Pacini-corpules are most sensitive at stimulus frequencies of 200 – 300 Hz, and can sense vibration amplitudes of as little as 0.1 µm. However, that also implies that for frequencies above 250 Hz, the sensitivity increasingly drops rapidly. Sound-shaping harmonics therefore remain mostly outside of the reach of the sense of touch, the feeling of vibration..

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\* due to the strong „damp-ing“.

**Fig. 0.1** shows the frequency dependency of the **vibration threshold**, i.e. the vibration amplitude that needs to be reached such that any vibration sensation can emerge in the first place. The exact shape of the curve depends not only on the frequency and the amplitude but also in the area of the vibrating surface, and on the stimulated location. The shown dependency can be seen as typical for the thenar (area below the thumb). If a guitarist, upon plucking the strings, feels a vibration in the body or the neck of the guitar, these will be predominantly in the low-frequency domain. If, as a **calculation to check the assumptions**, we take a force at the bridge of 10 N, a mass of 4 kg, and 250 Hz as excitation frequency, we get a displacement of 1  $\mu\text{m}$ . Hence it is no wonder that noticeable vibrations may be generated, even without any resonance-amplification.



**Fig. 0.1:** Vibration threshold (“Vibrationsschwelle”).

Only values that lie above the threshold lead to a vibration perception. According to this curve, a vibration with an amplitude of 0.4  $\mu\text{m}$  is noticeable at 300 Hz, but not anymore at 800 Hz.

“Schwingungsamplitude” = vibration-amplitude  
 “Frequenz” = frequency

Therefore, the question is not so much whether perceivable vibrations can occur but how these should be interpreted. Taking up Les Paul’s idea again, any noteworthy vibration of the guitar body would be counterproductive. With a lot of mass (a ten-pounder Paula), we would approach his ideal at the cost of comfortably carrying the instrument – and we would still disregard vibration-amplifying natural oscillations (Eigenmodes). The neck of the guitar in particular cannot be arbitrarily made heavier; it will vibrate noticeably in every guitar. However, what would happen if we could manufacture a guitar to be vibration-free? For comparable plucking, comparable strings would vibrate identically on every guitar of that kind! **Individuality is imperfection**, and it would fall by the wayside in this scenario. For the acoustic guitar, the luthier seeks to form the transmission factor in a frequency-dependent fashion, and therefore makes some frequency ranges radiate better, but others weaker instead. This way an individual sound results. The same principle could be applied for the electric guitar, and neck and body could be made to vibrate more strongly at certain frequencies i.e. to dissipate the vibration energy more quickly. Whether this is indeed desirable – that can only be assessed in an overall consideration of all sound-forming elements. It would however be a particular coincidence if it were exactly those frequency ranges that would require the strongest damping, in which the vibration perception is especially sensitive. One thing is clear beyond doubt: the source for the sensed vibration energy is the string. The more intense “the whole structure resonates”, the less the string vibrates because it loses its energy to “the whole structure” very quickly. One may disagree or agree with Les Paul’s ideas – going against the law of energy conservation is not advisable.

Disagreeing with Day et al., however, is at everybody’s liberty: “The vibrato system itself received a knife-edge arrangement at the six corresponding holes, such that the whole system had a very low-friction bearing but could still conduct the string vibrations optimally into the body. Yep, that’s a well-known path: **For the ignoble goes down to the (c)orc/pus in silence**. Schiller, Nānie (Nania). Or something like that.



## 0.4 The sound of the unamplified guitar

How does the expert test an electric guitar? By first listening to it without amplification (dry). "It is certain, that – contrary to common belief – the desired sound in electric guitars and basses does not predominantly depend on the pickups. Rather, the wood creates the basis. A guitar made from plywood will not sound good even with the best of pickups. When a customer approaches me here in the 'Guitar Garage' in Bremen and wants to discuss pickups, I first listen to the instrument without an amp" [Jimmy Koerting, Fachblatt Musikmagazin]. Or: "For the first assessment of the sound quality we need neither towering amps nor distortion devices, a small combo suffices. Of course, it would be even better to test the tonal behavior in a quiet corner playing 'dry', purely acoustically, and check with regard to attack, balance and sustain" [G&B 3/97]. How then can two guitars that differ in their 'dry' sound be unable to make this difference heard via the amplifier? "Surprisingly, the differences in sound show up to a much lesser degree when played through the amp, compared to the 'dry' test" [G&B 7/06]. Compared were: Gibson New Century X-Plorer and V-Factor. From another comparison test: "The Platinum Beast sounds (dry) powerful, warm and balanced, with a velvety brilliance and delicate harmonics. The Evil Edge Mockingbird somehow comes across as feeble, poor in the mids, with somewhat more pronounced bass, but instead is more brilliant and richer in harmonics. Thanks to the hot humbuckers, everything sounds very different when connected to the amp because – hard to believe – both instruments now sound all but identical" [G&B 8/06].

Extreme examples seem not to be of any help here. Plywood (or even rubber!) is called into action to serve as body-wood in order to justify the significance of, and necessity for, high-grade woods for the guitar body. That's the one extreme: with a totally unsuitable (highly absorbing) body, you cannot build a good guitar. Ergo-1: the wood is more important than the pickups. The other extreme: you switch a trebly ("underwound") Strat pickup for a bassy, treble-devouring Tele-neck-pickup boasting a thick brass cover, and postulate Ergo-2: the pickup is more important than the wood. Both considerations are too lopsided.

From the point of view of systems theory, the vibrating string is a generator that on the one hand excites the body and the neck to vibrate, both of which themselves radiate airborne sound. On the other hand, the relative motion between string and pickup generates the induced voltage. Airborne sound and voltage are therefore correlated – they result from one and the same source. If the string vibration dies off already after a few seconds, the pickup cannot make for a gigantic sustain. Or maybe it can, after all? Within certain limits it could indeed – in combination with a suitable amplifier (+ loudspeaker). If the amplifier limits the signal (overdrive, crunch), it actually changes the decay behavior. That's the decay behavior that is *audible via the loudspeaker*, because the decay of the string vibration is not changed, anyway. Or is it?? Now, the situation begins to become multitudinous ... and exactly for this reason we find so many contradictory opinions in guitar literature. If guitar and loudspeaker are located close together, feedback can certainly influence the string vibration, too. Which may be the reason for the expert-advice to first listen without an amplifier. Still: no guitarist will buy an electric guitar to always play in unamplified fashion. At some point, plugging-in will happen, and now the predictions from the 'dry' test are supposed to be vindicated. The probability of a favorable ending of the experiment is not entirely at zero – electric and acoustic sounds are somehow related (cor-related!), but how exactly cannot be seen at first glance.

Let us imagine a simple **experiment**: the pickups of a Stratocaster are screwed directly into the wood – this is to fully secure them in place. Oh, you reason that this step alone already changes the sound? Hm. Anyway, this special sound is taken as the reference. We have guitar, pickups – and now we get to the exceptional: once we play with pickguard, and once without. It's a *plastic* pickguard so that no metal layer can cause any eddy-current damping. Is a difference in sound audible if the guitar is played with pickguard, and then without? In the acoustic sound: definitely yes, in the electric sound: definitely no. If the pickguard is present, it is caused to vibrate via the guitar body. Having weakly damped natural frequencies (Eigenmodes), it can radiate audible sound in several frequency ranges. Do these vibrations of the pickguard act retroactively onto the strings. In theory: yes, because "All things are bound together. All things connect." (causality statement by Chief Seattle, sometime in the mid 1800's). Practically: no, since between pickguard and strings we have the guitar body which weighs in at a serious multiple of the mass of the pickguard. The string vibrations are influenced by the pickguard to such an insignificant extent that the electrical sound is not audibly changed. The radiated airborne sound, however, does of course change. Or another **example**: a singer performs in a concert hall. Listener A listens in the concert hall while listener B listens from the neighboring room via an open door. Now we close the door – what does change? A lot for listener B, practically nothing for listener A. Very theoretically we can again call for Chief Seattle's lemma, and demand a correction value for the wall absorption, but in this case there is no practical effect, as much as we might agree the Chief in general.

What's the singer got to do with the electric guitar? In both cases there are different transmission paths which change the sound conducted by them in a different manner. Knowledge about one transmission path does in general not allow for any conclusion about the other. The listener in the concert hall cannot be certain whether the other one (The Man Outside...) can hear anything at all. For the guitar, that implies: what can the nice acoustic sound do for me, if the pickup coil is ruptured? Careful though, were getting again into the domain of extreme positions. So let's assume an incomplete sound-insulation for listener B. He/she will then be able to give some statements: when is there singing, or a pause. Maybe he/she even recognizes which one of three singers is in the process to try to get to the high C at the given moment: the little one, the handsome one, or Fat Lucy. Issues with intonation will be audible even through the closed door, as long as the insulation is not complete. And even more so, if these issues are present in the expectation of the listener in the first place.

The thing with the expectations needs to be considered for the guitar, as well: it is astonishing how some guitar testers fall victim to their own conviction. Irrevocable **credo**: *"of course, the original Les-Paul-mix consisting of mahogany neck with rosewood fretboard and mahogany body with thick maple top will result in the one-and-only Les Paul sound"*. That's exactly how this needs to be written – in this case in a comparison test for guitars\*. And then a copy with an alder body (stigmatized with "!" in the test report) dares to sound good – even commands the tester's respect. *"... come alder ... come mahogany, it is anyway able to convince us with a first-class sound"*. Well, well, don't you exaggerate! Don't forget: we are talking about alder here! And lo and behold: *"...all in all a bit subdued and a little bit shy."* *There you go – typically alder!* However, oh great Polfuss, what happens only one column later, with the Fame LP-IV that's also in the test group? *"Those who dig a typical powerful, no-frills Les Paul sound, you should check out the Fame LP-VI. It indeed sounds the most authentic. Its sound is very close to the original in every range."* **Question**: according to the test-info, the Fame LP-IV has a maple neck, an oak fretboard, an alder body and a mahogany top. Did I get something wrong here?

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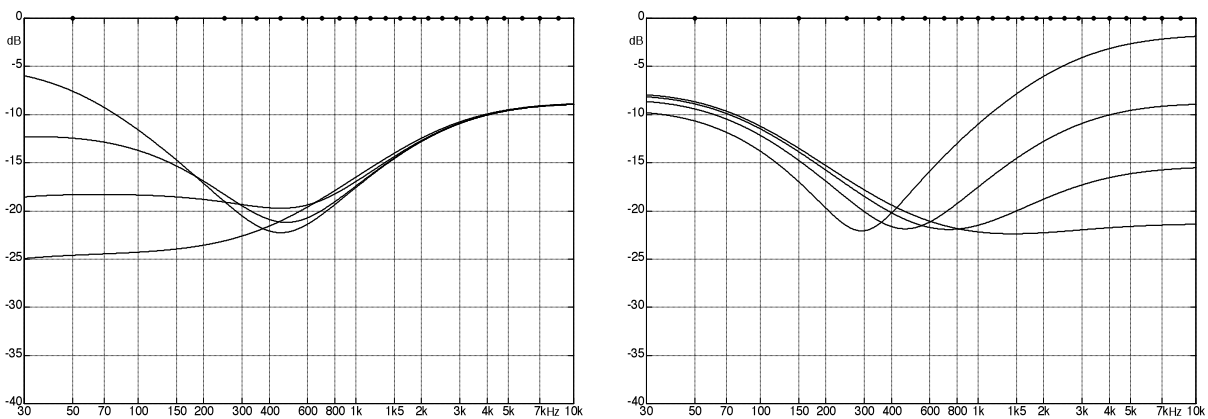
\* G&B 7/02

However, why don't we postpone the discussion on materials to later and return to the question: how far is the conclusion from the 'dry' test to the electric sound legitimate? Apparently there are "**robust**" signal parameters that win out in any signal path, and "**fragile**" parameters that change as they pass through a transmission medium. Pitch is fairly robust: whether the guitar is amplified or not, you will hear if it is in tune. Maybe not to the last cent (of pitch!), as the psycho-acousticians know, but with adequate accuracy for these first considerations. The balance between treble and bass, however, depends on the tone control settings on the amp – that is a trivial as it is uncontroversial. As hard as the sound from the guitar body may try – it will loose out to the fully dimed bass knob. "That's not what we mean", the expert may object, "in the 'dry'-test I listed to the foundations of the sound – to the soul of the wood." Now, please: dear physi-cists and psycho-cists, don't you get malicious here! A guitar tester does not have to have too much of a grasp of either physics or psychology, and he may present such a statement. The **soul of the wood** does not present itself prima facie, though. Many séances are required during which the spirit can permeate the matter. A lot of knocking on wood will be necessary, a tuning fork will have to be pressed against the solid body of a Stratocaster (at least according to Fender advertising), and ear-training over many years will be mandatory. We should be able to reach a consensus at least when it comes to this latter point, shouldn't we? The discussion is, after all, not supposed to be about the guitar-o-phobe agnostic suffering from chronically progredient dysacusis. It is about the more or less pronounced aficionado of the instrument – who, with a more or less extensive auditive experience, may indeed hear details in the sound that are not accessible to the layperson.

Enter the following problem: how do we describe such details in the sound? That is a classic task of **psychophysics** and psychometrics, and it often leads to a misunderstanding just as classic: a verbal description (dead, boxy sound) will be rejected at the scientific docking site as too ambiguous and imprecise, just as the exact description (degree of amplitude modulation of 8.43% at 944 Hz and with  $f_{\text{mod}} = 6,33$  Hz) is rejected by the musical/mystical faction as figment-y and way too abstract. Any proposals of compromise trying to connect the two worlds are consistently dismissed by both factions. Well then: rather than talking about the soul'o'wood, quite often a dead, or lively, sound is cited. How are dead matter and alive matter different? Alive matter will move! Ah ... you object already now because the pencil dropping from the table would then be alive? O.k. let's then turn to the basic philosophical consideration of life in particular and of existence in general ... NOT! **Alive means movement** – done and dusted! To translate that to the guitar: an artificial tone with strictly harmonic partials that all decay with the same time-constant – that will sound dead. Conversely, if the partials decay with different speed and with various beats, a sensation of movement and lively-ness will result. Here, the term "movement" may certainly be looked at in its original meaning as change of location: as a sound source changes its location in a (sound-reflecting) room, time-variant comb-filters make for differences in the signal spectrum, and the movement in space causes the "movement" in sound. In primeval days it presumably was conducive to survival to prioritize moving sound emitters over ones fixed in place, and at the same time early linguists discovered that speech sounds can carry information only if they include change. Without entering too far into foreign territory: there would be sufficient reasons why human hearing is constantly on the hunt for spectral *changes*. Even if the electric guitar is somewhat younger than roaring tigers and vandals going "Arrrghh!", the hearing possesses this ability to analyzes and it will use it. A lively tone rich in beats sounds more interesting than a dead one – at least as long as instrument-typical parameters are being kept.

Similar to the string pitch, beatings of partials can be rather **robust** towards the transmission parameters, and therefore it certainly is imaginable, that the expert can derive criteria of the electric sound already from the ‘dry’ test. Now, what does this robustness of the signal parameters depend on? Frequency-dependent signal parameters, such as the spectrum, lose their individuality if the corresponding frequency-dependent system parameter (the transmission function) has a similar shape. Three examples:

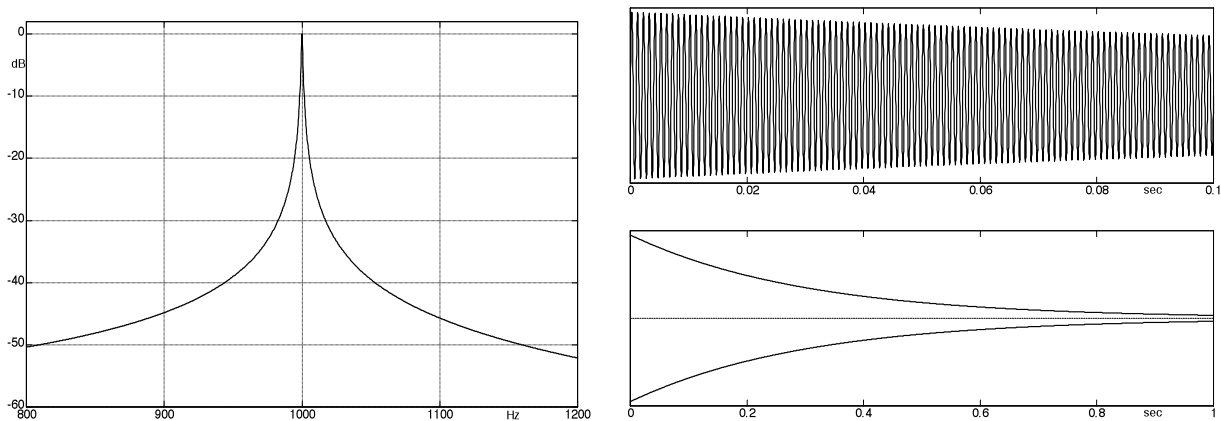
1) psycho-acoustics [12] describe the balance of treble and bass-y spectral contingents with the perceptual characteristic “**sharpness**”: sounds with an emphasis on treble have a strong sharpness. Turning down the treble control decreases the sharpness. Significant for the calculation of the sharpness is not so much the spectral detail, but the (smoothed) shape of the spectral envelope. To be more precise: sharpness is derived from the weighted loudness/pitch-diagram which will capture the frequency range relevant for the electric guitar at merely around 20 sampling points. Using the same spectral resolution, transmission frequency responses of guitar amplifiers may also be represented (**Fig. 0.2**). Looking at the relationship between the two datasets we can conclude that the sharpness of the ‘dry’ guitar sound will in general not correspond to the sharpness of the amplified sound. Put another way: changing the controls of the amplifier, we can change the sharpness of the sound – from this angle, sharpness is not a robust signal parameter.



**Fig. 0.2:** Tone control of a Fender amplifier (transmission factor). The points at the upper picture frame mark the critical-band grid (discretization of the abscissa for calculation of sharpness).

2) **Beats** between partials may be described as amplitude fluctuations in the time domain, while they can be seen as sum of closely adjacent partials in the frequency domain. For example, two same-level partials of slightly different frequency (e.g. 997 Hz and 1003 Hz) lead to the perception of a 1000-Hz-tone fluctuating in loudness with 6 Hz [3]. To change this beating, a highly frequency-selective operation needs to be carried out that would be untypical for tone controls on amps. As such, beats between partials are therefore robust relative simple tone-control networks.

3) The spectrum of a quickly **decaying** sine tone (**Fig. 0.3**) is predominantly limited to a narrow frequency range. Changes in the decay characteristic will therefore need to be carried out also via highly frequency-selective changes. In other words: a linearly operating, guitar-amp-typical tone-control network will leave the decay behavior of single partial practically unaffected; the decay behavior is robust in this respect.



**Fig. 0.3:** Decaying sine-oscillation,  $f = 1000$  Hz, time constant  $\tau = 0,3$  s.

These simplified presentations do need to be supplemented by a few points: it's not just the transmission factor of the guitar amp that changes the spectrum given by the strings – the loudspeaker (incl. its enclosure), too, acts as a filter, and in the detail its transmission curve is more frequency dependent than that of a tone-control network. The speaker membrane does not reach the high resonance Q-factors of decaying guitar partials; for that it would have to itself produce clearly perceivable tones – which it exactly does not. The last filter in the transmission path is the room with its reflecting surface. Its effect is not entirely negligible even for the 'dry' test, and when playing through amp and speaker, the speaker distance weighs in as another variable. However, as long as we stay within close range of the loudspeaker, the effects of the room may be regarded as being equivalent for both playing situations.

Special consideration needs to be given to those effects that result in more than what a simple tone control does. The addition of artificial reverb can extend decay processes and feign liveliness that is not included in the original signal in such a form. Chorus/phaser/flanger are time-variant filters of a high Q-factor, and their use always targets changes in the fine-structure of the partials. Compressors (in particular the multi-channel variant) change the decay constants of individual groups of partials. Overdrive has similar effects but adds extra partials. It is thus certainly possible to influence the signal parameters that have been categorized as 'robust' above. Still, without radical effects we can be successful within certain limits to infer the sound of the amplified electric guitar from the unamplified guitar. Which of the many beat- and decay-parameters, however, would be important for that 'good' sound ... that is only appraisable implicitly, in the best case. Moreover, we then get into the wide-open field of temporal and spectral masking [12], and therefore we can only draw the fundamental conclusion that **the sound of the unamplified guitar should in principle not be evaluated**. In particular in view of the expert's special knowledge (that has been accumulated over decades), and his/her specially trained ear, this rule does allow for exceptions ... in individual cases, and for that expert, the 'dry' test may reveal "everything", after all. The group of such experts who may take advantage of that exception comprises: guitar testers of all guitar magazines, all guitar sales personnel, all guitarist who have had, or have wanted to have a guitar for more than a year, all listeners (both CD and vinyl) who have the exact sound of Jeff Beck's signature guitar still ringing in their ears (see Chapter 7). And please, dear experts that now have received such extensive legitimization for your obviously indispensable 'dry' tests: we now should have consensus that the assessment of tactile vibrations is nonsense, shouldn't we?!

Concluding the topic of **guitar testing**, here are a few further citations:

**Yamaha** Pacifica guitars (maple neck, alder body) in a comparison test: "Acoustically, the basic characteristics of the Pacificas are readily comparable. Plugged in, however, they differentiate themselves rather clearly corresponding to the pickup complement" [G&B 6/04].

**Gibson** Les Paul Faded Double-Cutaway: "Right from the first plucking of the strings, it is clear that there is less damping of the resonance characteristics of the wood due to the low-key varnishing, The guitar resonates from head (machine heads) to toe (strap-pin) so intensely that I could even sense it in my own body" [G&B 6/04].

**Ibanez** IC400BK: "The slight underexposure of the E<sub>6</sub>-string found in the 'dry' test is suddenly gone as the pickups provide support." [G&B 6/04].

**Squier**-Stratocaster, comparison: **mahogany** body vs. **basswood** body: Using the middle and neck pickup, respectively, both guitars sound nearly identical." [G&B 5/06].

"Grabbing the **Pensa-Suhr** guitar and playing it unamplified, any reasonably trained ear immediate hears what it's at. ... Both seated and standing up, you feel the fantastic vibration behavior of the excellently tuned woods in your **belly**" [Fachblatt, 6/88].

"Despite the humbucker, a Strat can (sonically) never become a Les Paul" [G&B 2/00]. **Ozzy Osbourne** about Joe Holmes: "I don't actually like Fender guitars. But Joe gets this fulminant Gibson sound with them" [G&B 2/02]. "**Jimmy Page** recorded the complete first Led Zeppelin album using a Telecaster. The guitar sound on that album is exactly that of a Les Paul." (G&B Fender special issue). **Mark Knopfler**: "If I want a fatter sound, I'll use my Les Paul – it is simply more dynamic. That does not mean, however, that I could not do the same thing with a Stratocaster." [G&B Fender-Heft]. **Gary Moore**: "some people believe that you hear a Stratocaster on 'Ain't nobody', but in reality it's my own signature Les Paul." [G&B 7/06 p.91].

**High mass of wood (3,9 kg)**: Due to the big mass of wood, the response seems to be a bit ponderous, and the notes do not get off the starting blocks as quickly. [G&B 7/06].

Still heavier (**4,15 kg**): The guitar resonates intensely, has a direct and dynamic response; every chord and tone unfolds crisply and with great liveliness [G&B 8/06].

Despite the enormous mass of wood (**3,85 kg**) almost every note responds crisply and dynamically, unfolding very swiftly [G&B 7/06].

"Less mass can be made to vibrate more easily" [Thomas Kortmann, gitarrist.net].

A slender guitar **body** makes for a slender tone [G&B 7/02].

Thinner **body** = less bass [G&B 4/04].

**Fat neck** = sonically advantageous [G&B 8/02]. **Thin neck** = round, fat sound [G&B 10/05]. **Thin neck**: The less mass that needs to be moved, the more direct and quickly response and unfolding of the tone get off the starting blocks. [G&B 3/05]. **Crisp** and direct in the response, every tone gets off the starting blocks quickly and with great liveliness, **despite the immense mass of wood** (that indeed needs to be set in motion to begin with!) [G&B 9/05]. **A thin neck** has no acceptable vibration-characteristic whatsoever [G&B 3/97]. Of sonic advantage is that the **neck** weighs in with **a lot of mass** [G&B Fender special issue]. The **Ibanez JEM 777** features an extremely thin neck-construction: the sound character is powerful and earthy [Fachblatt, 6/88]. Of course the **neck shape** also contributes to the sonic character [G&B, 12/06]. What is not true at all is that **fat necks** sound better than thin ones. I have built the same guitar with a fat neck and a thin neck, and could not detect any difference [luthier Thomas Kortmann, Gitarrist.net]

Nay, that's past praying for [Shakespeare].

## 0.5 The Growse-Glowsock Affair

She already expected us. Second table on the right, as arranged. We, that was yours truly, specialist editor at Guitar Licks & Tricks, and Dick Johnson, our photographer (mind you, this is famous D.J., not the mute dweeb from Chapter 0.1). We had scheduled the date for 15:00, and she was on time. We as well, of course. It's not an every-day occurrence that you get the opportunity to meet the marketing CO of a famous tube distributor. Ms. Ann-Cathrin Growse-Glowsock, Psy.D., gave a most professional impression already from a purely visual point of view. "Whewww ... she lights me up like an AC30-deployed EL-84", Dick whispered under his breath as we approached. His thoughts must have already been on-topic, because today it was going to be about amplifier tubes. Meeting in a cafe seemed strange at first, but Growsock (as she was dubbed in the editorial office) had already apologized for any inconvenience: "we have such a bedlam in the test area right now, I don't dare let anybody in there." Of course we suspected that they had some exquisite new hyper-tubes – still secret. We hoped that we could elicit the odd detail out of her.

Having done the introductory prelude (here's my card – can I please have yours?) and a secret look to the bounty (indeed: "CO Marketing") we quickly got down to business: "Dr. Growse-Glowsock ..." "Please, that's Ann-Cathrin for you guys!" "Thank you! Ann-Cathrin, how do you manage again and again to find these great NOS-tubes?" "Well – that's a most difficult question – and right at the start!" she smiled flirtatiously, "that would be what we shall ask Ed, our director of purchasing – he'll join us later." Wow, this is gonna be a blast! "So you produce all the tubes here in Valleymoon?" "Oh no, of course not, we have a global network of suppliers. The US, Russia, China, Cambodia, Algiers, Laos, and many others." Of course ... stupid question ... wherever you can buy quality products. By now Dick had set up his camera and butted in, in his inimitable fashion: "your super-bulbs are really so GRAND, I'm over the moon with them." "Well, right now the KT-88 is indeed a top seller," she stand-offish-ly replied. My God, Dick – she's a manager with a doctorate ... could you find an any more dopey come-on? Another try: "Ms. Growse-Glowsock, with a doctorate under your belt, do you fare better in this man's world? You, as a woman ..." Oh sh.., that's not it, either. "I mean, not all of your competitors have staffed their exec-positions with university graduates, have they?" Phew ...in the nick of time ... "Would you pose this question to a man, too?" Her green eyes were painted every so lightly with this glittery stuff (well, not the eyes, but just above) ... it looked really good, even though she squinted now and then. Green glitter-eyes with that ginger mane ... oh, man ...well ... thank God she was not looking for an answer but continued: "actually, I first took courses in geography. Economic geography, to be precise. But during the 10<sup>th</sup> semester I realized that I was not going to get hired anywhere. So I broke off my studies and worked some casual jobs for a while." "Was that already in the electronics sector?" "No, that came but later. I worked at the university's copy-shop. That's where I took notice of a psychology professor. Or rather, he took notice of me." There was a bit of a mischievous smile on her face. The old story: *I once had a girl, or should I say, she once had me (L/McC)*. Psych-Prof ... 'course, as a specialist journalist, you can't compete. "So you got your doctorate with the psychologists?" "Yes! At the Institute for Speculative Psychology, with Professor van Bonner. You know him?" "Sorry, no. Speculative psychology?" "Right: what might Schopenhauer have said to Nietzsche? That was the subject of my thesis." "Very interesting. So what would he have said?" "Not much! Which is why I didn't have to write all that much – tee-heel!" Now the green ones smiled again. "Right, always economize," Dick barged in again. Before he could add a 'typical female!', I kicked him under the table. That must have hurt because he already hauled off for a counterstrike – but at that moment an immense behemoth approached our table, and Dick was distracted.

"Ah, here's Ed now, our managing director of production," she exclaimed with a honey-tone voice," Eddy-darling, sweetie – we're here!" Must have been easily some 250 lb of sweetness that came crawling towards us. Designer specs, grey braid at the back of the neck: Eddy. "Director of purchasing or of production?" I quietly asked because my memory couldn't fit it all together. He heard it and introduced himself right away: "Edward Growse, purchasing and production." Understood – it does happen in big corporations that a board member takes care of two divisions for some time ... or maybe cost-saving measures? Whatever. "I tidied up, we can go in" Ed reckoned, saving the day for Dick, because a few pics had to be taken (location, location ... or genius loci, as Growsock probably would have put it). We paid up and piled into the SUV. "Fasten seatbelts, please – Eddy really hits the breaks when a speed camera is indicated!" Sure, we'd do the same. And off we went: on the road to Tubilic, Ltd.

"Ann-Cathrin, you mastered in psychology but now work in tube marketing? ..." "Indeed. You know, when after 16 semesters I checked out the employment market for speculative psychologists ..." "...you realized that ..." "exactly! And then Hans, my professor, had less and less time for me because of his wife, so it was a lucky coincidence that Eddy and his band played a gig at the university." Such is life – hence the double name. Spontaneous idea: back home they would have a vacancy for the chief district executive ... no, maybe not. The west of the city almost silently rolled past the V12, the streets became narrower and more contorted. As Ed pulled into the driveway with the triple garage, a giant Great Dane yelpingly jumped up to the fence. They wouldn't have a little nosh for us before we ... "Jeez, you got a lovely place here – that tube business brings in some heavy dough, doesn't it?" Oh no - who had made this retard my photographer! Luckily, Growsock had already gone ahead to the door, and Ed pretended not to have heard anything: "Let's go downstairs to the test-field right away." Yikes! So THIS WAS Tubilic! *He* boxes and *she* types up the invoices! That's almost like we had seen it in Tonopah at the pickup guru's ... Never mind, we'll see it through now. Ed already opened one of the many basement doors. Neon tubes flickered to life, bathing meticulously stacked-up small cardboard boxes in cold light. Tidy it was – gotta give the guy that. Gold Lions, old GECs, new Tungsols, everything accurately piled up. "Ed. You have ..." the remainder of the sentence was drowned out by infernal bellowing that all of a sudden burst forth from the other side of the door. "Bonzo would like to say hi", Eddy remarked with a malicious smile, and opened the door. This was the Scottish version of the Great Dane. They stand about a yard high at the shoulder. In their younger years. Fully grown that may increase to 4 ½ ft. The Giant Scottish Great Dane will measure yet another foot on top of that, at the very least. As long as they do not bob up ... it won't, will it? ... Noooo ... of course it will. The dog was completely overjoyed, woof-woof, pant-pant ... if at least not that 2-ft-tongue ... and that deafening roar in the reverberant basement ... the things you gotta endure as journalist ... "Has he happened to waggle down an expensive tube sometime?" Well then, Dick could indeed also shoot good questions, although the present situation necessitated a lot of accompanying gesturing – multi-medial communication, in a way. But as quickly as it had come, the episode was over: upstairs Growsock clanked a pot, there was one last "Ch-ch-ch", and the dog was gone. I'll have to get at least 20% hardship allowance for all this ... or else the editor in chief will have to do the job himself next time.

Where were we? "Ed, which is the better tube, the 6L6-GC, or the 5881?" Again, Ed displayed that malicious smile: "That would be the 5881 – we get a better markup on that." Big laughs. "But don't you write that in the article. On the other hand: most people know that anyway, don't they?" He added: "6L6-GC for your average moron, 6L6-WGC for the one seeking to spend a bit more, 5881 as premium-merc, and 5881-WXXS for the snobs. The insides are always the same". Ed's laughter was suddenly interrupted by very enraged green eyes that must have finished taking care of guzzle-guzzle and wanted to attend to the visitors.



"His humor takes some getting-used-to, but with tubes he's really on top of the game, like no other" she sought to distract. "Of course, the insides are NOT always the same: this 5881-WXXS here e.g. is a heavy-duty-version with brown base, while the regular 5881 over there has the black base. That is something entirely different." Dick shot a querying glance at Growsock and released the shutter: once brown, once black. No, he had not forgotten to put in a color film – we are a specialist publisher, after all, and have been working with digital for years. Digital in color, even.

For confirmation, Growsock now brought on the big guns: instrumentation! "With the 5881, we get about 10% more compared to the 6L6" she remarked. "Occasionally – when a special order comes in, we can even measure power. We have bought a gadget specifically for that." She pointed to a contraption that probably was a tube-testing device: "on the left side, the 5881 has about 10% more than the 6L6." Dick industriously kept shooting, and I decided to enter the professional discourse: "Left, that would be ..." "She means the instrument on the left side", Ed seconded, "we operate in a highly targeted, concise manner. No superfluous pleasantries. *10% more on the left*, and everybody knows what is meant." "So what does the left device register?" "Well, the tube that has been inserted. Plug in, there we go." Quickly, another question – before Dick comes up with the next mischievous idea: "That will then be the plate-current that is shown on the left instrument?" Ed was not in the mood to get a lot into theory, though, and preferred to remain very practical: "we first do a selection process on all tubes: those with the straight glass container get loaded onto the blue trolley, the bulbous ones are placed on the yellow one. I think every musician has the right to selected tubes. In fact, the guys in China should already do the selecting, but since Sinh Ter has left the export division, we occasionally receive the tubes in a rather colorful mixture. Logn San, the new guy, is just too ..." "He is in training and will be certified soon. We ale vely 'appy wit te tube man'factulel." Growsock's humor certainly was of a different caliber. "The individual numbers printed onto the boxes, this 34/-52, for example, that ... " "... that's already on the boxes. Although I think you can order the cartons without those numbers. Nobody does that, the market demands the numbers, and we serve the market."

This had turned out to be an interesting meeting, after all. "You imply that you have not laser-printed these labels individually but ... isn't that deceit, somehow? Or even ..." Now our psychologist sooo got going ... there was a job market for speculative psychology, after all: "you have no clue, do you! You're absolutely 404! A musician on stage, opening up to the world, in a way baring his or her soul – will he or she not need the maximum in gear performance that the market can offer? Feed selected premium ware to the combo amp, maybe even remakes of the legendary black-plate powerhouses with the larger and longer base – that will give him or her that vibe ... no: the FORCE to be truly inspired!" "Jack, you got shots of the meter? Maybe Annie ... sorry: Ann-Cathrin ... could sit beside it giving you a smile? I'll get into some more technical stuff with Ed, meanwhile." She didn't give up that easily, though. "You sell an 6L6 for \$5 to the players – they surely feel they're getting pure rubbish. Can't go in front of an audience with that. A 5881-JKAS at \$49.90" ... (Ed's 'with the same junk inside' got drowned out by the dramatically mounting fortissimo) ... "that'll do the magic and make them play like gods. Like Clapton at 22, like Morse and Moore combined in one person!" O.K. – she knew her stuff. "So it's all psychology?" "Nonsense – of course an el-cheapo tube can't cut it like a premium tube will." Now they seemed to switch roles; apparently Eddy-darling wanted to remain at the wheel, too: "That needs to be clarified from the ground up. Tubes: not just anybody can do that. We are the champions here."

He elaborated: “a JKAS for example will give you those satin highs, with a well defined share of bass and lots of headroom. The JRK, on the other hand, delivers particularly delicate, mild treble, well-defined bass and powerful mids, and the BLL has those tight basses, strong mids and satin treble, and headroom in spades. A 5881 puts out delicate treble, creamy sustain, particularly mild mids, with great headroom. The 5881-TLT brings creamy treble, fine sustain, powerful bass ...“ he faltered “... no, that’s strong bass. Powerful bass, that’s the 5581-WNK. And, of course, the 5881-WNK/JRK-STR-highgrade. The latter combined with particularly silky and super-clean treble.” Growsock applauded ecstatically. “That’s why I put him in charge of production”, she remarked smugly, and immediately added “Without Eddy, this joint wouldn’t do so wonderfully – he knows tube specs like no other.”

"And the numbers, those on the boxes?" Dick tried to dig deeper. "Numbs are for dumbs," Ed laughed. "It's only on the balance sheet, where numbers you have got to read." Not a man modeled after Leo F., then. We needed something tangible, though, to keep the head-editor-boss out of our hair. Next try: "The JKAS features gold-plated grids, doesn't it? That's in order to ..." "Gold is a precious metal", Growsock embarked. "The more precious the metal, the more classy the sound – pure logic. You wouldn't want to wear an aluminum ring on your finger, either, now would you?! Gold grids, and a black-anodized glass bulb." "...and the longest cylinder possible," Dick barged in, only to sulkily shut up again with an "Ouch!" "Are NOS-tubes indeed as good as they are said to be? They've been lying around for a number of decades, after all?" "In most cases, it is not possible to exactly date NOS-tubes," Growsock submitted sibilantly. "We are always happy when again somebody finds a case in some attic, and we hope that such tubes continue to be found for a long time. Myself, I just a few months ago discovered a huge supply back in the old country, in the basement of the house my grannie was in the process to sell. More than 1000 pieces! One has to wonder about all the stuff that people hoard." "And these are truly old?" "Of course! My granny's house was in the area where the GDR used to be, actually very close to the SOG-Tube-combine. She always said 'vee haf nossing ofer herrr', but what the little they had, sey haf nott srone away. I was just surprised that Ed didn't find those tubes. He rummaged around in that basement for days before I arrived. Wonder what he was looking at and for, my darling blind-shell!" "Main thing is you keep turning up those antique precious tubos – I'll sell 'em."

Those two truly had found their perfect work-sharing arrangement. Ann-Cathrin and Edward: enterprising, slaving away serving the discerning guitarist, supplying premier tubes. Their business was indeed going well, although ... "The competition does not concern you at all?" "Well, the guys at TOD, The Other Distributor, they do niggle us. But the grapevine says they are not getting a grip on their personnel expenses. We have a different scenario here." The green ones were gleaming again. "Plus, we do have some big names under contract, our party really rocks! What's-his-name – no, musn't tell you who – buys three new quartets after every gig ... and he's gigging almost daily. What wicked endorsement!" "Huh? Doesn't endorsement imply something like sponsoring? The guy *pays* for his tubes?" "Sure, his roady was a bro' in the old commune – convinced our man that this brown, way-cool – no: way-hot sizzle only is on when he's burning our prewar-MOV's. We call it an endorsement because, in a way, he's endorsing our V12. And that's just him alone! That is so cool. That endorsement, that is so ... so ..." "Von Holen?" "Right!"

Dear Ann-Cathrin Growse-Glowsock, Psy.D., dear Growse, Edward – thank you for having us. And special regards to Stronzo, or whatever its name was.

**Counter statement, on behalf of Ms. Glowstock, Phy.D.**

In the so-called “pre-release of Physics of the Electric Guitar”, a series of untrue allegations about me are included. In this respect, I state:

- 1) My name is not at all Growse-Glowsock but Grous-Glowstock.
- 2) I have done studies neither in economic geography, nor in speculative psychology. Correct is rather that my doctorate had the subject: *“The difference between being in itself and being per se from the point of view of solipsism – and the corresponding criticism by Schopenhauer”*.
- 3) My assigned doctorate supervisor was neither an alcoholic nor was he “Prof. Hans van Bonner”. It seems there was confusion with Edward Grous’s student band “Van Bonjovous”.
- 4) The “pre-release” creates the impression that I had red hair. Correct is that I am blond; a natural blonde, all over.
- 5) The “pre-release” creates the impression that I had relations with my doctorate supervisor that ended at the intervention of his wife. Correct is that his wife did not even know about me at the point in time.
- 6) The “pre-release” creates the impression that our company would select tubes merely according to color and/or shape. Correct is that we certainly select according to other aspects. For this, we deploy expensive special equipment.
- 7) The “pre-release” creates the impression that I would not know what is indicated on the “left instrument”. Correct is that I know very well that “mA” is indicated there.
- 8) My grandmother did not live in the GDR, but in Poland; she hailed from Upper Silesia. Never were any tubes found in the basement of her house. She passed away already 11 years ago, not “a few months ago”.
- 9) The “pre-release” creates the impression that 50% of our company’s tubes would be rejects. I state: this is untrue. 50% of our tubes are not rejects.
- 10) Edward Grous and I do not drive a V-12 but an S-63 that, according to the manufacturer’s specifications, has not 12 but 8 cylinders (source: WWW.Mercedes-AMG.com).
- 11) The “pre-release” creates the impression that we would gain economic advantages from “Von Holen”. Correct is that we do not know “Von Holen” at all.

August 24, 2010, Anna-Katerczyna Grous-Glowstock

Statement by the author:

Applicable law requires the publication of a counter statement without appraisal of its content. I wish Ms. Glowstock that she may recognize with Schopenhauer that her being in itself and per se is not so terrible, after all.

August 25, 2010, Prof. Dr.-Ing. Manfred Zollner