LGRP was funded by the European commission's Erasmus+ Program

guitars from non tropical woods

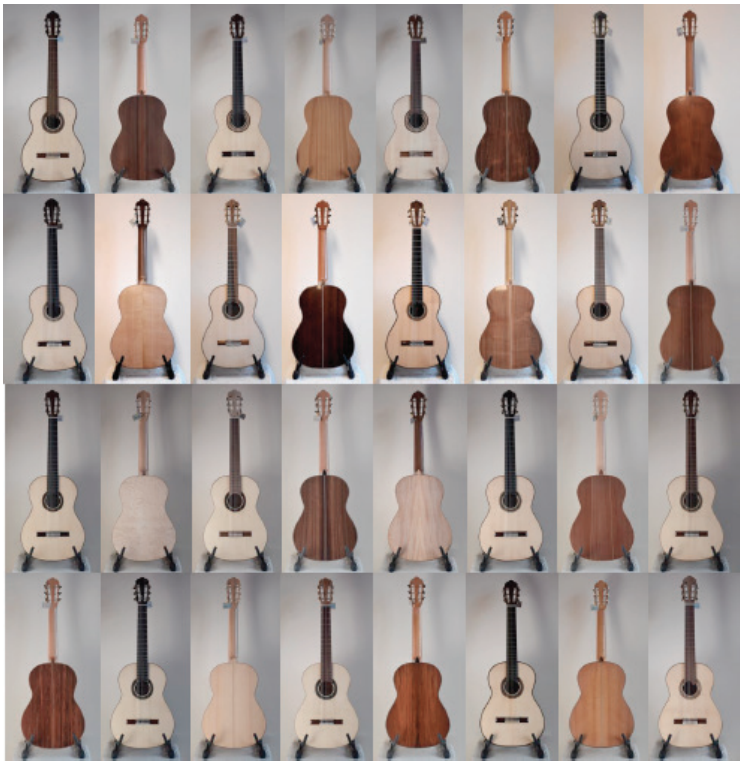
leonardo-guitar-research.com

Leonardo Guitar Research Project

Online listening test with guitars made from tropical wood and guitars made from non-tropical wood

With this study we tried to find an answer to the following question: will assessors be able to distinguish guitars made from tropical wood species from those made with non-tropical wood species when they hear the guitars played one after the other all embodied in one sound track.

Research by Jacky Walraet, Kristof Meeus, David Jeremiah, 2017
Guitar player: Gaëlle Solal



CONTENTS

1- INTRODUCTION

Since 2014 the Leonardo Guitar Research Project (LGRP) has been conducting several tests and experiments to investigate the possibilities of using non-tropical wood species in guitar building.

LGRP playing and listening tests;

LGRP study #1
In 2014 the Leonardo Guitar Research Project conducted its first study using blind and non-blind playing and listening tests. 10 classical guitars made from non-tropical woods and 5 classical guitars made from tropical woods were assessed, using a number of different methods, by 3 guitarists/3 listeners and 2 audiences (66 listeners).

LGRP study #2
At the beginning of 2017, new blind and non-blind playing and listening tests, with a larger number of guitars and players, were carried out, using 44 guitars made by 22 builders at 3 lutherie schools based in 3 countries;
- 16 classical guitars were made in Cmb, Belgium -
- 4 classical guitars were made in Newark college, UK
- 12 steel string guitars were made in Cmb, Belgium
- 12 steel string guitars were made in Ikata, Finland.

The builders made 'pairs' of guitars, one from tropical wood and the other from non-tropical wood. (This had not been the case in the first study). In total, over the 3 countries, 20 guitar professional players carried out test sessions.

LGRP study #3
For this test we employed the 16 classical guitars made in Belgium that had been used during the second study. This time, however, the listening test was carried out using an online survey. Over a two week period 226 people participated in the test.

2 - ABSTRACT

2.1 About the listening test

The aim of this online listening test (LGRP study #3) was to see if a new and completely different method would confirm the findings from the previous two LGRP studies
.
All guitars were made to the same model (design and plan by Walter Verreydt & Karel Dedain, based on a Bouchet contour). Each builder made a matched pair consisting of one guitar made from local, non-tropical wood and one guitar made from traditionally used tropical wood. The top plates for all guitars were made from European spruce.

A musical piece - Tristorosa by H. Villa Lobos - was recorded on each of the 16 guitars. These recordings were subsequently cut into sections of the desired length and then edited together into a fluent musical piece. Participants in the test were asked to listen to the musical piece online and then complete a survey in which questions such as: How many guitars did you perceive ? How many of the perceived guitars are made from non-tropical wood species ? Etc. were asked. (see 'Methodology')

2.2 Concise summary of main findings

The audio track consisted of 16 guitars. In response to the question - How many guitars did you perceive ? - the average number given by the respondents was '5'.

All 226 respondents perceived combinations of several guitars (which included both T's and NT's) as being ONE single guitar.

It was virtually impossible to distinguish between guitars made from tropical wood species from those made from non-tropical wood species.

In this test no clearly distinctive sound qualities or characteristic nature could attributed to either group - T's or NT's.

The findings clearly confirm the results of the LGRP studies #1 and #2.

3 - MATERIAL AND METHODOLOGY

3.1 How the test was presented to the public.

The online test was presented to the public via social media, mailings and newsletters in English and French.
This is the text the public was given:

ENGLISH

About tonewoods / take the listening challenge.

In addition to the wood used for the top plate, many people consider that the tonewoods used for back and sides, bridge, fingerboard and neck also contribute to the sound of a guitar. For this listening challenge a video was made in which several guitars, made from different wood species, were recorded and assembled into one fluent musical piece.
In this challenge you will first hear the audio track from the video. Once you have completed the survey you will receive the full video (audio+visual) where you can see the guitars being played and discover which woods they are made from.

Click on the Youtube link (https://youtu.be/GhssVjSsBKs / audio only) and listen carefully to the music and the sound of the guitars. Please try to use high quality headphones or audio equipment.
Some of the guitars are made from traditionally used tropical tonewoods like rosewood, ebony, mahogany and Spanish Cedar. Other guitars are made from local and non-commonly used non-tropical wood species.
All guitars are of the same model. They all have European spruce tops, the same bracing pattern and the same strings. They are recorded with a flat EQ. No audio editing or effects are added.

After listening please go to this survey:
https://surveymonkey.com/r/T8Z6STH
to answer questions such as:
- How many guitars did you perceive ?
- How many of the perceived guitars are made from non-tropical wood species.
From the survey you can go back to the audio to listen as often as you wish.
Only answers send via the survey will be accepted.
Please leave your e-mail address in the survey if you want to stay updated.

THANKS for participating in this test !
NOTE: The survey will remain online for 2 weeks and will close on 26.06.2017

FRANCAIS

À propos des bois de lutherie / Défiez votre écoute !

En plus du bois utilisé pour la table, beaucoup pensent que les bois de lutherie utilisés pour le dos et les éclisses, le chevalet, la touche et le manche contribuent également au son d'une guitare. Pour ce défi d'écoute, une vidéo a été créée dans laquelle plusieurs guitares fabriquées à partir de différentes espèces de bois ont été enregistrées et assemblées dans une seule pièce musicale fluide et continue. Dans ce défi, vous entendrez d'abord la piste audio de la vidéo.
Une fois que vous aurez terminé l'enquête, vous recevrez la vidéo complète (audio + visuelle) où vous pourrez voir les guitares jouées et découvrir les bois avec lesquels elles sont fabriquées.

Cliquez sur le lien Youtube (https://youtu.be/GhssVjSsBKs /audio uniquement) et écoutez attentivement la musique et le son des guitares. Essayez d'utiliser un casque ou un équipement audio de haute qualité.

Certaines des guitares sont fabriquées à partir de bois tropicaux traditionnellement utilisés comme le palissandre, l'ébène, l'acajou et le cèdre. D'autres guitares sont fabriquées à partir d'espèces de bois non tropicales locales et non couramment utilisées. Toutes les guitares sont réalisées autour du même modèle. Elles ont toutes des tables en épicéa européen, le même type de barrage et les mêmes cordes. Elles ont été enregistrées avec un EQ plat. Aucun montage audio ou aucun effet n'est ajouté.

Après avoir écouté, passez à ce sondage:
https://surveymonkey.com/r/T8Z6STH pour répondre à des questions telles que:
- Combien de guitares avez-vous perçues ?
- Combien de guitares perçues proviennent d'espèces de bois non tropicales ?
À partir de l'enquête, vous pouvez revenir à l'audio pour écouter le plus souvent possible.
Seules les réponses envoyées via l'enquête seront acceptées.
Veuillez laisser votre adresse e-mail dans le sondage si vous souhaitez être informé des résultats.

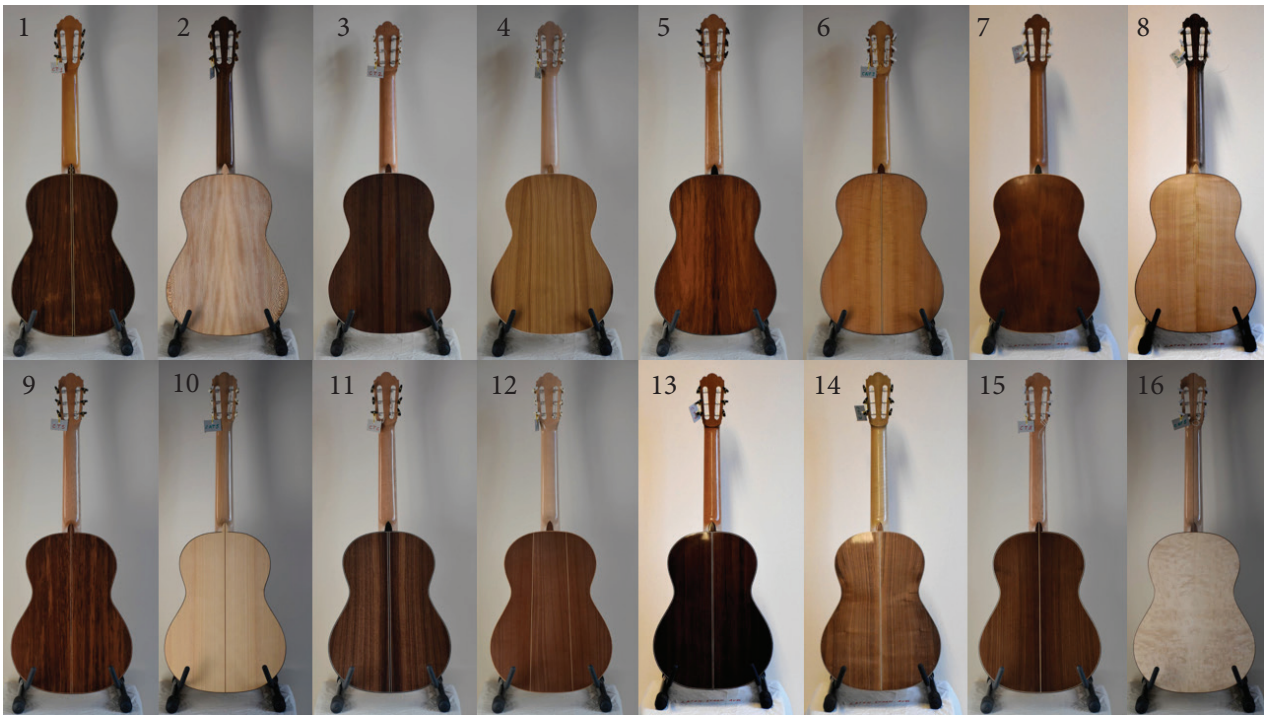
MERCI d'avoir participé à ce test!
NOTE: L'enquête restera en ligne pendant 2 semaines et se terminera le 26.06.2017

3.2 Material

- The audio used for the test: https://youtu.be/GhssVjSsBKs
- The video (of the audio) that people could see after the survey had expired: https://youtu.be/RPgpioRTO34
- Number of guitars in the audio/video: 16
- Number of builders who made the guitars: 8
  Each builder made a pair of guitars consisting of one made from tropical woods (T) and one made from non-tropical woods (NT). The pairs appear consecutively in the track.
- Order of the 8 T's and the 8 NT's in the track:
  T / NT / T / NT / T / NT / T / NT / T / NT / T / NT / T / NT / T / NT
- The 15 transition time points:
  0:10 / 0:23 / 0:36 / 0:51 / 1:03 / 1:22 / 1:28 / 1:43 / 2:00 / 2:10 / 2:18 / 2:31 / 2:42 / 2:50 / 2:59

3.3 The Guitars

- All guitars were made within the same time span, 2015/2016.
- All guitars are of the same model and have the same strings.
- The wood species are variable for parts such as: back/sides, bridge, fingerboard and neck but NOT for the top plate; all guitars have European spruce tops and the same bracing pattern.



- The wood species used per part:

		Wood species			
		Back/sides	Neck	Fingerboard	Bridge
Builder 1	Guitar 1	Rosewood, Indian	Spanish Cedar	Ebony	Rosewood, Indian
	Guitar 2	Plane	Walnut	Robinia (darkened)	Robinia (darkened)
Builder 2	Guitar 3	Rosewood, Indian	Spanish Cedar	Ebony	Rosewood, Indian
	Guitar 4	Laburnum	Alder	Laburnum	Laburnum
Builder 3	Guitar 5	Rosewood, Madagascar	Spanish Cedar	Ebony	Rosewood, Madagascar
	Guitar 6	Pear	Cherry	Oak (darkened)	Oak (darkened)
Builder 4	Guitar 7	Mahogany, Cuba	Mahogany	Ebony	Rosewood, (baroni)
	Guitar 8	Cherry	Walnut	Laburnum	Laburnum
Builder 5	Guitar 9	Rosewood, Madagascar	Spanish Cedar	Ebony	Rosewood, Indian
	Guitar 10	Cypress	Cypress	Robinia (darkened)	Robinia (darkened)
Builder 6	Guitar 11	Rosewood, Indian	Spanish Cedar	Ebony	Rosewood, Indian
	Guitar 12	Robinia (darkened)	Alder	Laburnum	Laburnum
Builder 7	Guitar 13	Rosewood, Indian	Spanish Cedar	Ebony	Rosewood, Indian
	Guitar 14	Walnut	Chestnut	Walnut	Robinia (darkened)
Builder 8	Guitar 15	Rosewood, Indian	Spanish Cedar	Ebony	Rosewood, Indian
	Guitar 16	Maple	Alder	Walnut	Walnut

- All guitars were made in the Centre for Musical Instrument Building (CMB, Belgium) under the guidance of master luthiers and guitar making teachers Walter Verreydt and Karel Dedain. All guitars are of the same model. They all have European spruce tops, the same bracing pattern and the same strings.
These 16 guitars were also used for blind and non-blind playing and listening tests in the LGRP Phase #2 study.

3.4 - Recording / Mastering
The musical piece - Tristorosa by H. Villa Lobos - was recorded on each of the 16 guitars.
These recordings were edited into sections of the desired length and then pasted together into one musical piece.
All guitars were recorded with a flat EQ. For the mastering, no audio effects were added.
The guitars were recorded in stereo (X-Y technique) using two cardioid Neumann KMi microphones.
The reverb is natural: large room, 9m long x 6m wide x 5m high.
To minimise the risk of deviation, the position of the left hand, the position of the guitar in relation to the microphones, and the playing style were strictly controlled throughout the 16 recordings.
The player, Gaëlle Solal, is world-class. Her masterful control guarantees consistent and even playing on all the instruments.
http://www.gaelle-solal.com/

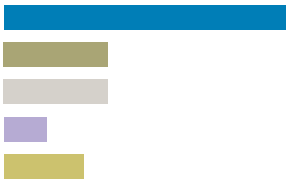
3.5 - Questions in the survey
1: Please check the option, which best describes the audio quality you used for listening.
2: If you had NOT known that there were several guitars in the track, would you have noticed it ? (*this question requires an answer)
3: How many guitars did you perceive ? (*this question requires an answer)
4: If you perceived more than one guitar, please tell us where the transition(s) between the guitars took place. Note the transition time point(s) (when one guitar follows another) in the box below. For example, if you detected 5 guitars you need to fill in 4 time points, separating them with a slash, e.g. 0:28 / 0:56 / 2:16 / 2:56 (this question can be skipped)
5: Can you distinguish the tropical wood guitars from the non-tropical guitars? (This question requires an answer)
6: If you answered YES to question N° 5, please tell us the nature of the guitar (T= tropical; NT=non-tropical) according to the order in which you detected them (for example, if you detected 5 guitars: T, T, NT,T, NT). (This question can be skipped).
*Participants could leave their E-mail address to receive the full video and the results. They also could write their comments in a text box.

4 - RESULTS

Number of respondents: 226

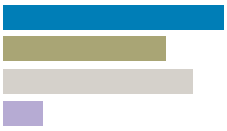
Quality of audio used by the assessors
Question 1: Please check the option, which best describes the audio quality you used for listening.

Answers/results:
- Quality headphones connected directly to a device: 46%
- Low quality headphones connected directly to a device:17%
- Quality speakers connected to an amplifier: 17%
- Low end speakers connected to an amplifier: 7%
- Built-in device speakers: 13%

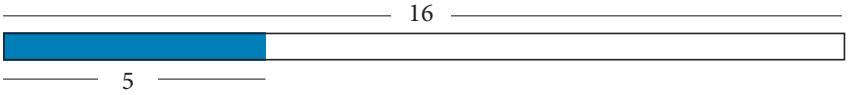


Awareness
Question 2: If you had NOT known that there were several guitars in the track, would you have noticed it ? (*this question requires an answer)

Answers:
- No, I would not have noticed : 36%
- Yes, I would have noticed: 26.5%
- Maybe: 31%
- Others: 6.5%



Perceived guitars
Question 3: How many guitars did you perceive ? (*this question requires an answer)
Result: Average number of perceived guitars over 226 respondents: 5 (out of 16)



Transition time points

Question 4 : If you perceived more than one guitar, please tell us where the transition(s) between the guitars took place. Note the transition time point(s) (when one guitar follows another) in the box below. For example, if you detected 5 guitars you need to fill in 4 time points, separating them with a slash, e.g. 0:28 / 0:56 / 2:16 / 2:56 (this question can be skipped)

Answers/results:
- 80 respondents (out of 226) provided time points / 146 skipped the question
- 8 respondents failed to provide the information in the form requested
- 72 respondents noted a total of 420 transition time points (average: 5,8 time points out of 15)
- Total number of correctly detected time points over 72 respondents = 312 (average: 4,3 time points out of 15)
  N.B.: a margin of error of 2 sec. before and 2 sec. after the actual second where the transition took place was applied.
- Total number of correctly detected time points excluding the margin of error = 135 (average: 1,8 time points out of 15)
- Total number of wrongly detected time points out of 420 (i.e; where no transition took place) = 108.

Nature of the guitars (T or NT)

Question 5 : Can you distinguish the tropical wood guitars from the non-tropical guitars? (this question requires an answer)

Answers:
- No: 72.25%
- Maybe: 23.25%
- Yes: 4.5%

Question 6 : If you answered YES to question N° 5, please tell us the nature of the guitar (T= tropical; NT=non-tropical) according to the order in which you detected them (for example, if you detected 5 guitars: T, T, NT,T, NT). (This question can be skipped).

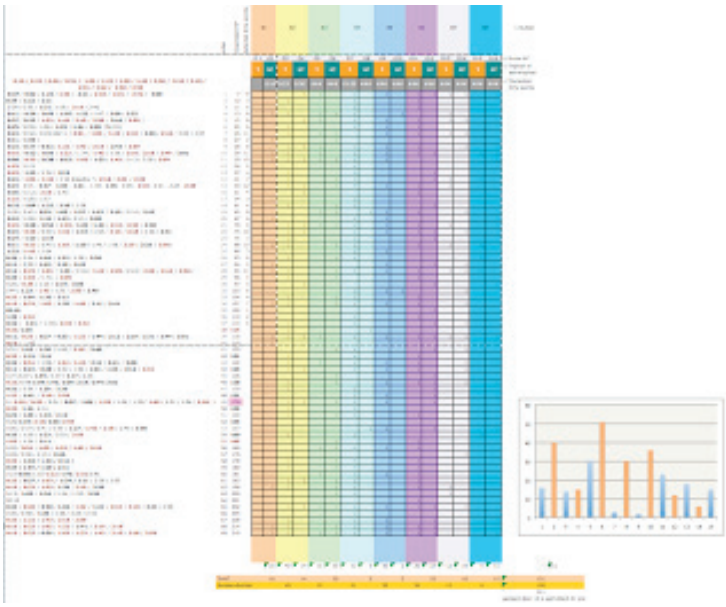
Answers/results:
- 29 of the 226 respondents answered / 197 skipped
- 6 respondents failed to provide the information in the form requested
- 23 respondents provided the information in the form requested
- Total number of identified natures (T or NT) by the 29 respondents = 119 (average: 4)
- 9 identifications correctly matched the nature of a guitar with its corresponding timeslot (transition points)
- 110 identifications failed to correctly match the nature of a guitar with its corresponding timeslot. Either the timeslot was correct but the nature was wrong, or the timeslot given encompassed 2 or more guitars consisting of T's and NT's.

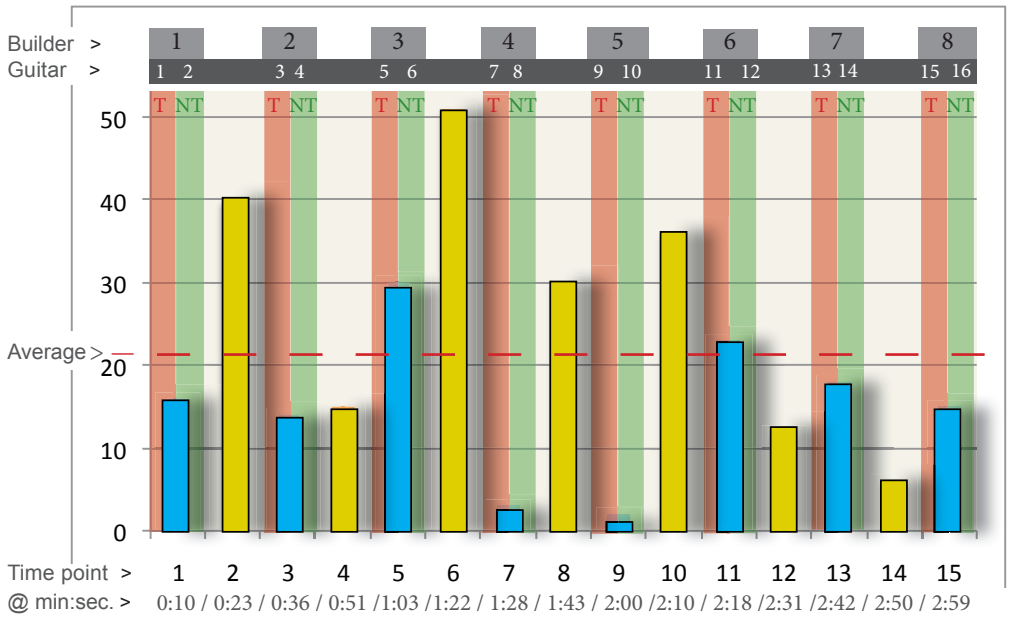
Supplementary findings concerning the transition time points and the builders

The 16 guitars played on the track alternated throughout according to their nature (T/NT; T/NT etc.) with a total of 15 transition points. Because the guitars were presented in pairs according to their builder, there are also 7 transition points between the different builders' guitars. (These 7 points mark the transition between one builder's NT guitar and the following builder's T guitar). The results show that the average number of transitions detected between the guitars of different builders was higher than the average number of transitions detected between the T and NT guitars of individual builders.

For example; transition 6 (between builder 3 and 4) was detected by 51 respondents. The following transition - between builder 4's two guitars - was only detected by 3 respondents.

All correctly detected time points were compiled into an excel file which was used to make a graph showing the results per transition time point and guitar builder. See figures one page 8





Horizontal axis

- 1 — 8 Builders
- 16 Guitars (each builder made a T and a NT guitar)
- T NT — Tropical and Non-tropical guitar from a same builder (Guitar Pair)
- Number of detected time point transitions between a T and NT for the same builder
- Number of detected time point transitions between a T and NT for a different builder
- Average off all correct detected time points (156) over all respondents

Time point > 15 transition time points between 16 guitars played in the track.

@ min. : sec. > Time in minutes and seconds where the transition took place

Vertical axis:

50 40 30 20 10 0 — Total number of correct detected time points over all resondents

5 - CONCLUSIONS

- All 216 respondents perceived combinations of several guitars (including both T's and NT's) as being ONE guitar.

- In this test it was very difficult to differentiate one guitar from the other, and virtually impossible to distinguish between guitars made from tropical wood species from those made from non-tropical wood species.

- Although several people demonstrated outstanding listening abilities (by indicating 7, 8 to 9 correct transition time points), the ability to detect the nature of the guitars was notably less pronounced.

- This test shows that the distinctive sound qualities and the supposed nature of T's and NT's were not distinguishable one from the other.

- This test implies that neither group (Tropical or Non-Tropical) possesses inherently distinctive, readily identifiable sound qualities.

- Indeed, as there are clearly more time points detected between T's and NT's made by different builders than time points between T's and NT's made by a given builder, it would appear that the builder may have a more pronounced effect on differences in sound quality than the wood species used for back/sides, bridge, fingerboard and neck.

  We should, however, exercise caution as some respondents indicated in their comments that they were able to detect transition points based on "clicks" caused by editing rather than on a perceived difference in sound quality between guitars. We are still in the process of analysing whether or not there were more detectable "clicks" or other editing phenomena between different builders than between guitars from the same builder.

- Furthermore, if we consider other studies on this subject, the question has to be asked as to whether the woods for back/sides, bridge, fingerboard and neck are really as important as has been previously assumed.

6 - EXTRA INFORMATION

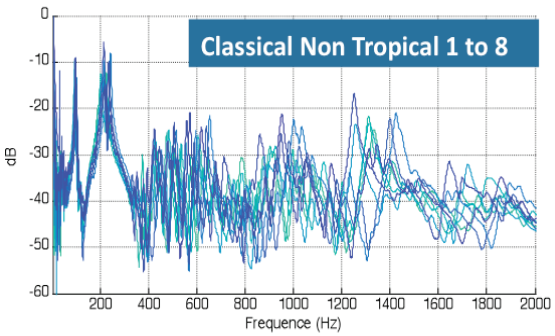
- 71 comments of participants (before the results were published) can be found on:
  http://www.leonardo-guitar-research.com/comments-online-test-1

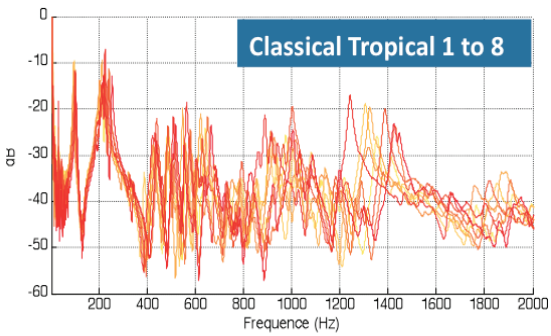
- All 16 guitars were subjected to tests (acoustic signature) by François Gautier (Professeur en Acoustique/vibrations Laboratoire d'Acoustique de L'Université du Maine) and colleagues. The results of this study will be published later on http://www.leonardo-guitar-research.com and other sources.


Analyse des caractéristiques acoustiques de guitares construites avec et sans bois tropicaux - projet Leonardo

F. Gautier, G. Michelin, C. Zhou, F. Ablitzer, G. Paiva, E. Brasseur, M. Secail, B. David

Laboratoire d'Acoustique de l'Université du Maine
UMR CNRS 6613,, Av. O. Messiaen
72085 Le Mans cedex 9, France
Francois.Gautier@univ-lemans.fr





7 - BIBLIOGRAPHY

Samuele Carcagno, Roger Bucknall, Jim Woodhouse, Claudia Fritz, and Chris Plack / Lancaster University / Guitarists' evaluation and discrimination of steel-string acoustic guitars built with back/side woods of varying price, prestige, and sustainability (2017) : http://asa.scitation.org/doi/10.1121/1.4988661

Samuele Carcagno and colleagues / Lancaster University / An ongoing study on the preferences of guitar players for different woods used for the back and side plates of guitars. http://www.psych.lancs.ac.uk/hearing/the-guitar-experiment

E. Parizet, N. Hamzaoui, G. Sabatié: Comparison of some listening test methods: a case study. Acta Acustica United with Acustica 91 (2005)

C. Traube: An interdisciplinary study of the timbre of the classical guitar. Dissertation. McGill University, (2004).

8 - ACKNOWLEDGMENT

The authors are grateful to the Cmb[1] crew:

- Peter De Rop
- Brian Garston
- Walter Verreydt
- Karel Dedain
- Toon Dockx

and especially to:

- Tero Siromaa for the idea of the online test
- Gaëlle Solal for the wonderful guitar playing ♥
- Jacques Carbonneaux and Simon Burgun for the 'French' support
- Brian Garston, Adrian Lucas and David Jeremiah for the 'English' support
- R.M. Mottola for the advice and suggestions.
- Tania Spalt, Jacques Carbonneaux, James Lister and David Collett for the dissemination of the survey.
- the outstanding guitar builders:
  - Hans Van Velzen
  - Sandra V.D. Jeught
  - Amélie Bouvret
  - Johan Saerens
  - Paul V.D. Weerdt
  - Daniël Fuszesi
  - Dirk De Roo
  - Walter Van Bruyssel

[1] Cmb; Centre for Musical Instrument Building, Belgium. / www.cmbpuurs.be

MAIN RESULTS

Respondents

• Number of respondents = **226**

Used audio quality by the assessors

Question 1: Please check the option, which best describes the audio quality you used for listening.

Answers:

- Quality headphones connected directly to a device: 46%
- Low quality headphones connected directly to a device: 18%
- Quality speakers connected to an amplifier: 17%
- Low end speakers connected to an amplifier: 7%
- Built-in device speakers: 15%

Awareness

Question 2: If you had NOT known that there were several guitars in the track, would you have noticed it ? (*this question requires an answer)

Answers:

- No,I would not have noticed : 36%
- Maybe: 31%
- Yes, I would have noticed: 26.5%
- Others: 6.5%

Perceived guitars

Question 3: How many guitars did you perceive ? (*this question requires an answer)

• Average number of perceived guitars over 226 respondents = **5** (of 16)

Transition timepoints

Question 4 : If you perceived more than one guitar, please tell us where the transition(s) between the guitars took place. Note the transition time point(s) (when one guitar follows another) in the box below. For example, if you detected 5 guitars you need to fill in 4 time points, separating them with a slash, e.g. 0:28 / 0:56 / 2:16 / 2:56 (this question can be skipped)

• 80 respondents (on 226) noted timepoints
• 8 respondents gave unvalid answers or notes.
• 72 respondents noted 420 transition time points where they percieved that one guitar follows another (average: 5,8 time points on 15)
• Total number of 'correct' detected timepoints over 72 respondents = 312 (average: 4,3 timepoints on 15)
NOTE: (a tolerance of 2 sec. before and 2 sec. after the second where the transition happened is been applied)
• Total number of 'correct' detected time points on the second where the transition happened (excl. tolerance) = 135 (average: 1,8 time points on 15)
• Total number of wrong detected time points on 420 (where no transition took place) = 108 (26% wrong)

ABSTRACT / continuation

Nature of the guitars (T or NT)
Question N°5 : Can you distinguish the tropical wood guitars from the non-tropical guitars? (*this question requires an answer)
Answers:
No: 72.25%
Maybe: 23.25%
Yes: 4.5%

Question N°6 : If you answered YES to question N° 5, please tell us the nature of the guitar (T= tropical; NT=non-tropical) according to the order in which you detected them (for example, if you detected 5 guitars: T, T, NT,T, NT). This question can be skipped.

- 29 of the 226 respondents answered / 197 skipped
- 6 gave an unvalid answer or note.
- 23 respondents gave a valid answer
- Total number of identificated natures by 29 respondents = 119 (average: 4)
- 9 identifications were right.
- 110 identifications were wrong (mostly consisting of minimum 2 guitars with a different nature or wrong identificated nature)

Suplementary findings about the Builders

- Not olnly the 16 guitars pased one by one during the track, but also the 8 builders with their guitar pair (T + NT) pased one by one. In that way assessors were not only perceiving different guitars but also different builders per 2 guitars. Although transitions of guitars between builders include as well transitions of T's and NT's, results show that the amounth of detected transitions between builders are much higher than those between T's and NT's made by a same builder (!). Details see next pages

CONCLUSIONS

- All respondents perceived several guitars, T's and NT's together, as being ONE guitar.
- Altough several people showed to have very good ears (by indicating 7, 8 to 9 correct transition time points), for those who tried, they were not able to correctly indentify the nature of the percieved guitars
- In this test it was very difficult to perceive one guitar from the other, and actualy impossible to distiguish the guitars made from tropical woo species from those made from non-tropical wood species.
- This test shows that the distinctive sound qualities and the supposed nature of T's and NT's were not distinguishable one from the other.
- As there are clearly more timepoints detected between T's and NT's made by different builders than time points between T's and NT's made by a same builder, there is a possible indication that it rather could be the builder that makes the difference, more than the wood species used for back/sides, bridge, fingerboard and neck.

REFERENCES

- This online test confirms the results of earlier LGRP studies. Reference: Studies Phase #1/Phase #2 (see LGRP website), and blind audience tests with a comparable audio/video where 12 steel-string guitars were used in one track (link). (see...)
- Studies from other researchers concerning the nature of guitars made from different wood species: Reference:

MATERIAL, detailed information

The guitars
All guitars were made in the Centre for Musical instrrument Building (CMB, Belgium) under guidence of master luthiers and guitar making teachers Walter Verreydt and Karel Dedain. All guitars are of the same model. They all have European spruce tops, the same bracing pattern and the same strings.
The same set of guitars was used for blind and non-blind play and listeng test in the LGRP Phase #2 study.

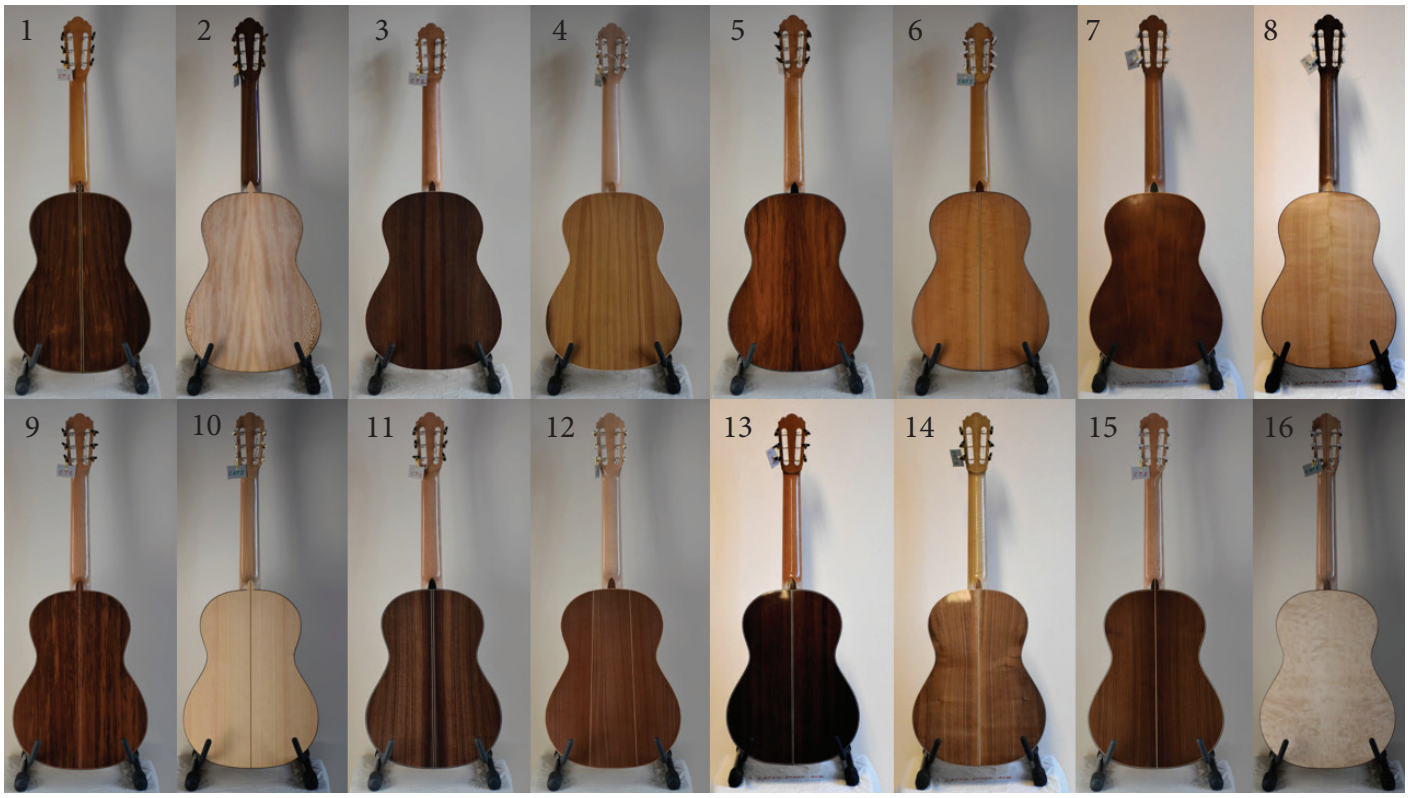


fig.1 Back view of the 16 guitars

		Wood species			
		Back/sides	Neck	Fingerboard	Bridge
Builder 1	Guitar 1	Rosewood, Indian	Spanish Cedar	Ebony	Rosewood, Indian
	Guitar 2	Plane	Walnut	Robinia (darkened)	Robinia (darkened)
Builder 2	Guitar 3	Rosewood, Indian	Spanish Cedar	Ebony	Rosewood, Indian
	Guitar 4	Laburnum	Alder	Laburnum	Laburnum
Builder 3	Guitar 5	Rosewood, Madagascar	Spanish Cedar	Ebony	Rosewood, Madagascar
	Guitar 6	Pear	Cherry	Oak (darkened)	Oak (darkened)
Builder 4	Guitar 7	Mahogany, Cuba	Mahogany	Ebony	Rosewood, (baroni)
	Guitar 8	Cherry	Walnut	Laburnum	Laburnum
Builder 5	Guitar 9	Rosewood, Madagascar	Spanish Cedar	Ebony	Rosewood, Indian
	Guitar 10	Cypress	Cypress	Robinia (darkened)	Robinia (darkened)
Builder 6	Guitar 11	Rosewood, Indian	Spanish Cedar	Ebony	Rosewood, Indian
	Guitar 12	Robinia (darkened)	Alder	Laburnum	Laburnum
Builder 7	Guitar 13	Rosewood, Indian	Spanish Cedar	Ebony	Rosewood, Indian
	Guitar 14	Walnut	Chestnut	Walnut	Robinia (darkened)
Builder 8	Guitar 15	Rosewood, Indian	Spanish Cedar	Ebony	Rosewood, Indian
	Guitar 16	Maple	Alder	Walnut	Walnut

fig.2 Used wood species per guitar

METHOD

Recording / Mastering

The musical piece - Tristorosa by H. Villa Lobos - was recorded on each of the 16 guitars.
All pieces were cut to the desired section and pasted together into one musical piece.
All guitars were recorded with a flat EQ. For the mastering no audio effects were added.
2 Neumann KMi microphones were used for the stereo recording.
The reverb is natural (big room of 7m long x 5m wide x 5m high)

Online

The video (sound only) and the survey were put online from... /... (20 day's).
The test was distributed via social media, newsletters, mailings or via a shared link to the LGRP website.
This was the text that was communicated:

In addition to the wood used for the top plate, many people consider that the tonewoods used for back and sides, bridge, fingerboard and neck also contribute to the sound of a guitar.
For this listening challenge a video was made in which several guitars, made from different wood species, were recorded and assembled into one fluent musical piece.
In this challenge you will first hear the audio track from the video. Once you have completed the survey you will receive the full video (audio+-visual) where you can see the guitars being played and discover which woods they are made from.
Click on the Youtube link (https://youtu.be/GhssVjSsBKs / audio only) and listen carefully to the music and the sound of the guitars.
Please try to use high quality headphones or audio equipment. Some of the guitars are made from traditionally used tropical tonewoods like rosewood, ebony, mahogany and Spanish Cedar. Other guitars are made from local and lesscommonly used non-tropical wood species.
All guitars are of the same model. They all have European spruce tops, the same bracing pattern and the same strings. They are recorded with a flat EQ. No audio editing or effects are added.
After listening please go to this survey:
https://surveymonkey.com/r/T8Z6STH
to answer questions such as:
- How many guitars did you perceive ?
- How many of the perceived guitars are made from non-tropical wood species.
From the survey you can go back to the audio to listen as often as you wish. Only answers send via the survey will be accepted. Please leave your e-mail address in the survey if you want to stay updated.
THANKS for participating in this test !
NOTE: The survey will remain online for 2 weeks and will close on 26.06.2017

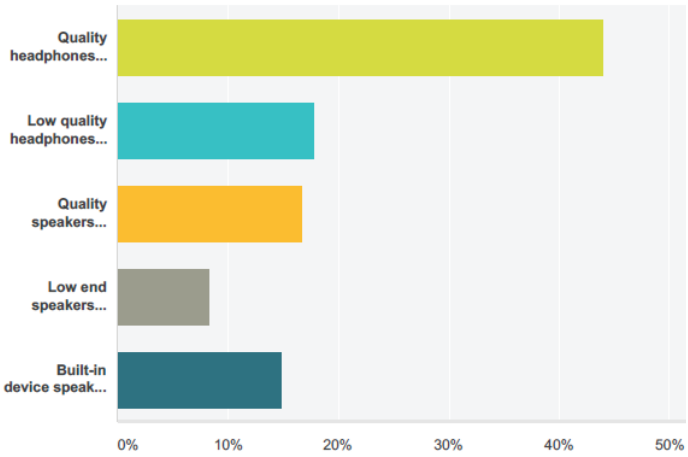
Questions and tasks in the survey:

1 - Please check the option, which best describes the audio quality you used for listening.
Options:
2 - If you had NOT known that there were several guitars in the track, would you have noticed it ? (this question requires an answer)
Options:
3 - How many guitars did you perceive? (this question requires an answer)
4 - If you perceived more than one guitar, please tell us where the transition(s) between the guitars took place. Note the transition time point(s) (when one guitar follows another) in the box. If you detected 5 guitars you need to fill in 4 time points, separating them with a slash. For example: 0:28 / 0:56 / 2:16 / 2:56. (this question can be skipped).
5 - Can you distinguish the tropical wood guitars from the non-tropical guitars ? (this question requires an answer)
Options: YES / NO / MAYBE
6 - If you answered YES to question N° 4, please tell us the nature of the guitar (T or NT) according to the order in which you detected them.
For example, if you detected 5 guitars: T, T, NT,T, NT. (this question can be skipped)
7 - Please leave your e-mail address in the text box. The full video (audio+film) and the answers to the questions will be send to you. We will respect your privacy.
Options: YES/NO
You can also leave your comments in the box.
To complete the survey click on 'DONE'

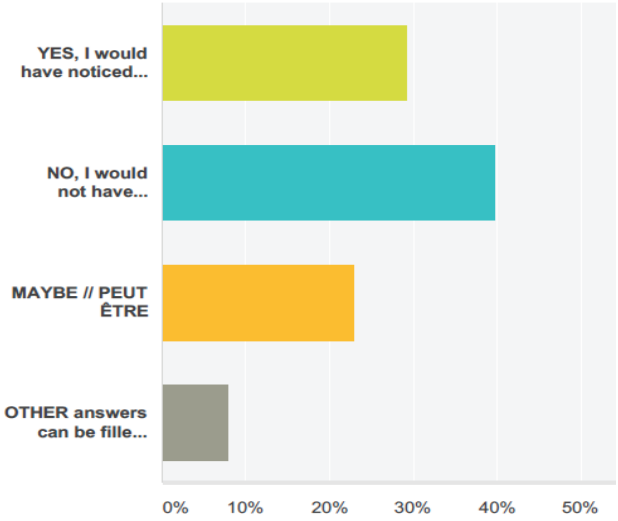
The survey in PDF format can bee sen here (link)

RESULTS per questions

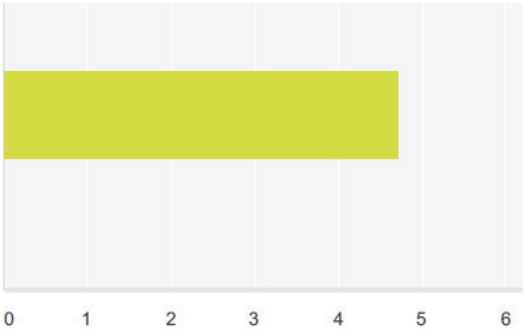
1 - Please check the option, which best describes the audio quality you used for listening./ options:



2- If you had NOT known that there were several guitars in the track, would you have noticed it ? / options:

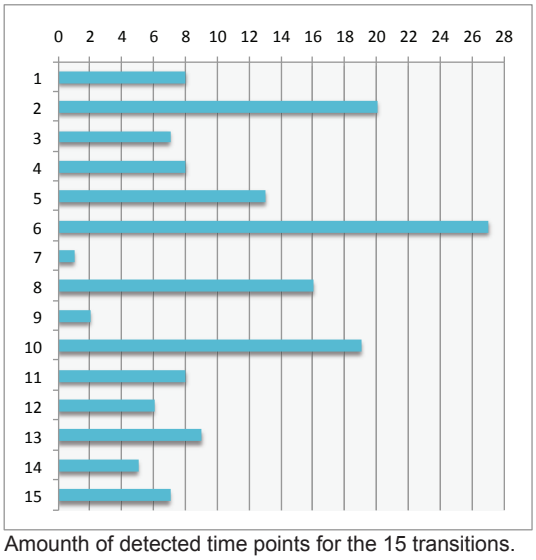


3 - How many guitars did you perceive?



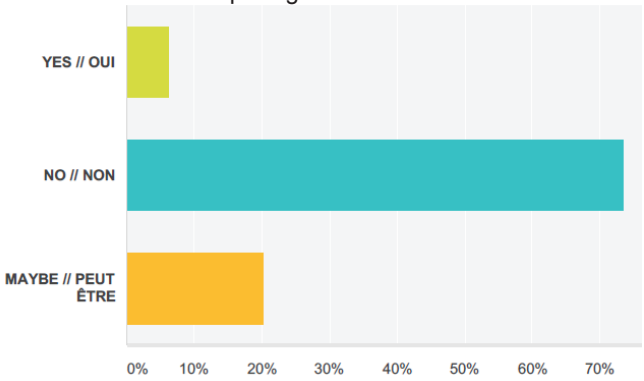
Average of the perceived guitars over 120 respondents: 4,8 (of 16)
details see next pages

4 - If you perceived more than one guitar, please tell us where the transition(s) between the guitars took place.



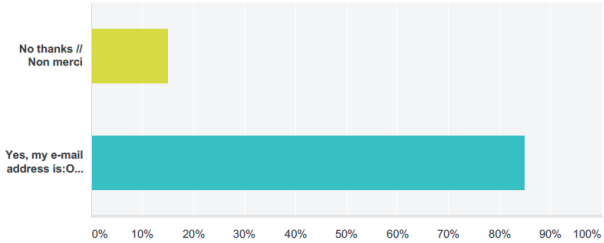
Amounth of detected time points for the 15 transitions.
details see next pages

5 - Can you distinguish the tropical wood guitars from the non-tropical guitars ?

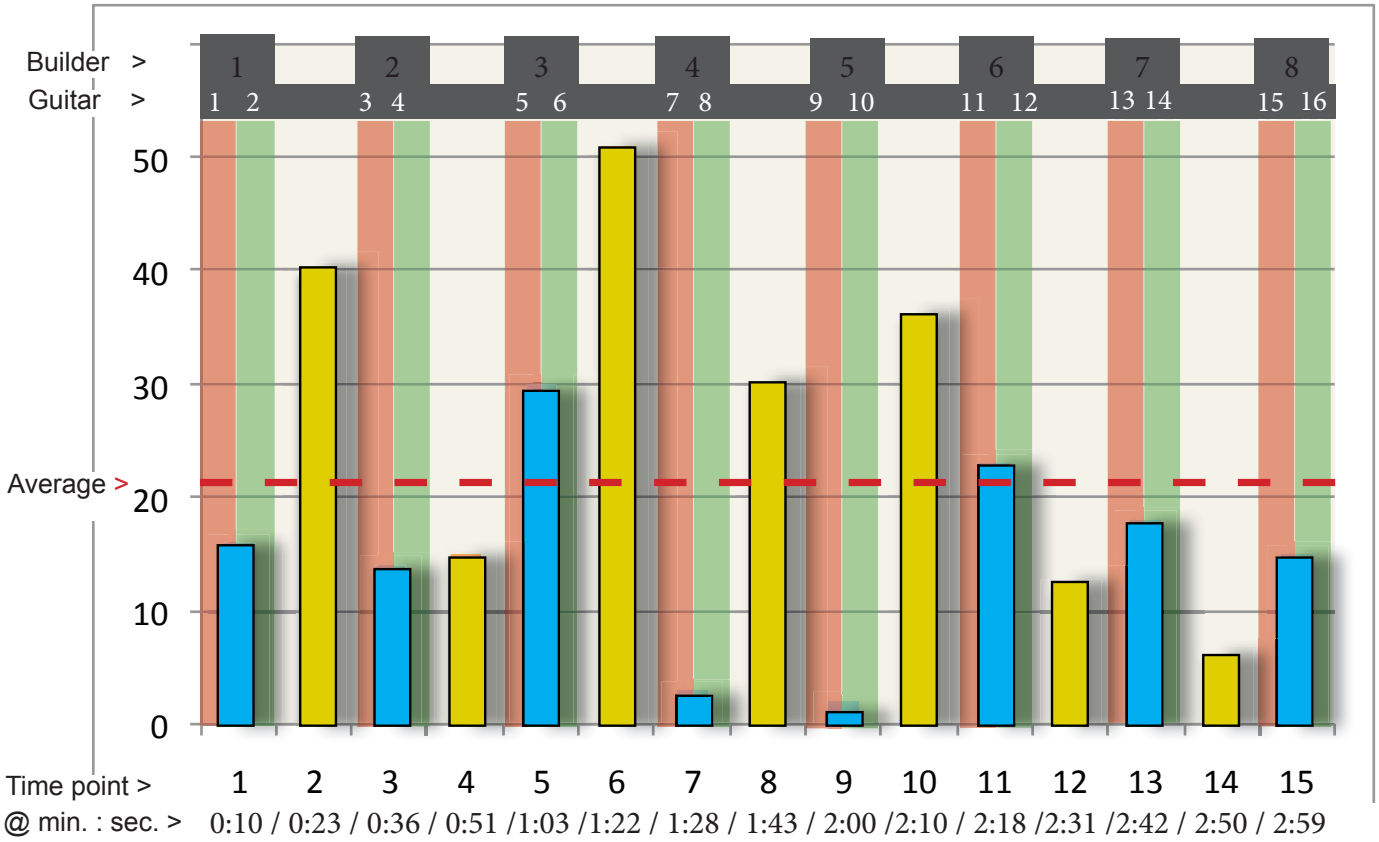


6 - If you answered YES to question N° 4, please tell us the nature of the guitar (T or NT) according to the order in which you detected them.
detailed analyse about the time points see next page

7 - Please leave your e-mail address in the text box. The full video (audio+film) and the answers to the questions will be send / options: NO / YES



Time points analyses



Horizontal axes

1 8 Builders

1 2 16 Guitars (each builder made a T and a NT guitar)

T NT Tropical and Non-tropical guitar from a same builder (Guitar Pair)

Number of detected time point transitions between a T and NT for the same builder

Number of detected time point transitions between a T and NT for a different builder

Average off all correct detected time points (156) over all respondents

Time point > 15 transition time points between 16 guitars played in the track.

@ min. : sec. > Time in minutes and seconds where the transition took place

Vertical axe:

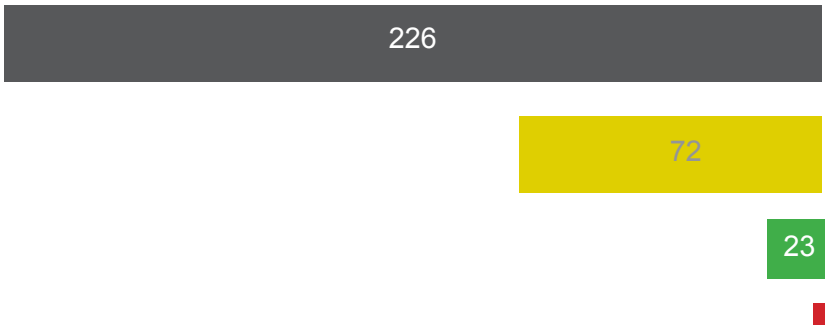
Total number of correct detected time points over all resondents

TOLERANCE for "correct" transition time points:

All time points within 2 seconds before and 2 seconds behind the actual transition points were accepted as right. Without that tolerance only ... of the ... time points were exact on the transition times.

Online blind listening test

with 16 classical guitars; 8 made from tropical wood species and 8 made from non-tropical wood species. All guitars are of the same model. They all have European spruce tops, the same bracing pattern and the same strings. The woods for back/sides, neck, fingerboard and bridge are variable. The guitars are recorded with a flat EQ. No audio editing or effects were added. Audio on https://youtu.be/GhssVjSsBKs



You can hear AND SEE the guitars and find all info on:
http://www.leonardo-guitar-research.com/online-blind-listening-challenge

Question

Are assessors able to distinguish guitars madfrom tropical wood species from those made with non-tropical wood species when they hear them played one after the other in a same musical piece ?

Respondents and Results

226 respondents completed the survey. They all had to point how many guitars they had percieved. The average number of percieved guitars was **5** (of 16)

72 respondents noted time points where they detected transitions.The maximum number of correct detected time points for a respondent was **9** (of 15)

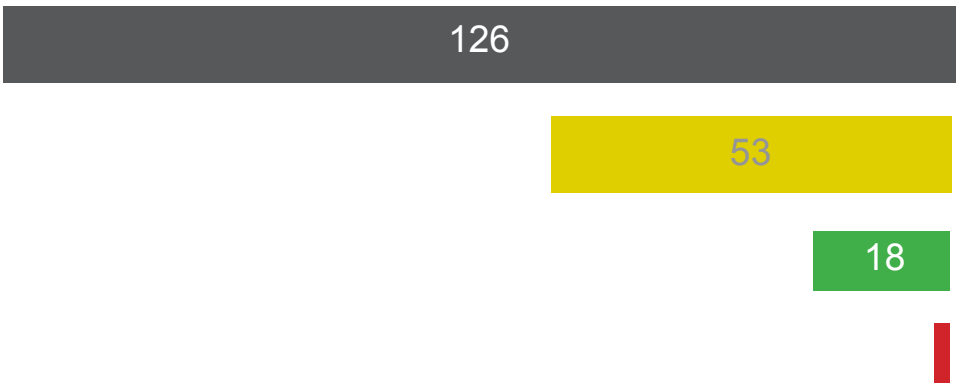
23 respondents noted, beside the time points, also the nature of the guitars (tropical or non-tropical)

4 respondents together **correctly identified 9 natures** related with correct noted time points.

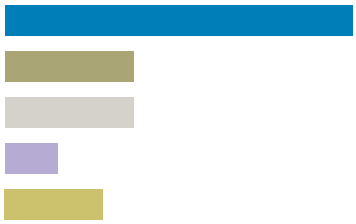
As each of the 226 respondents had the possibiliy to point the nature per guitar, there were 3.616 posibilities to do so (226 respondents x16 guitars). Considering only the 23 respondents who pointed the nature of the guitars (23 x 16 guitars = 368) the percentage for correct answers is 2.5%. (Note also the 50% chance level)

Conclusion

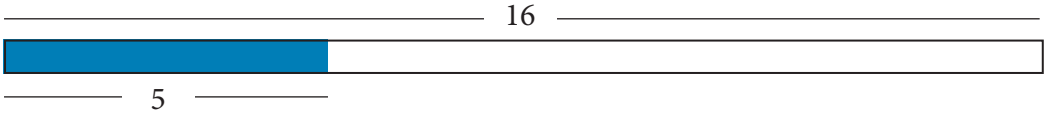
Altough some people showed to have very good ears (by indicating 7, 8 to 9 correct transition time points), they were not able to correctly indentify the nature of the percieved guitars (or they didn't even try to do so). In this test it was very difficult to perceive one guitar from the other, and actualy impossible to distiguish the guitars made from tropical wood species from those made from non-tropical wood species.



- Quality headphones connected directly to a device: 46%
- Low quality headphones connected directly to a device:17%
- Quality speakers connected to an amplifier: 17%
- Low end speakers connected to an amplifier: 7%
- Built-in device speakers: 13%



- No, I would not have noticed : 36%
- Yes, I would have noticed: 26.5%
- Maybe: 31%
- Others: 6.5%



- No: 72.25%
- Maybe: 23.25%
- Yes: 4.5%