

The development of guitar constructions

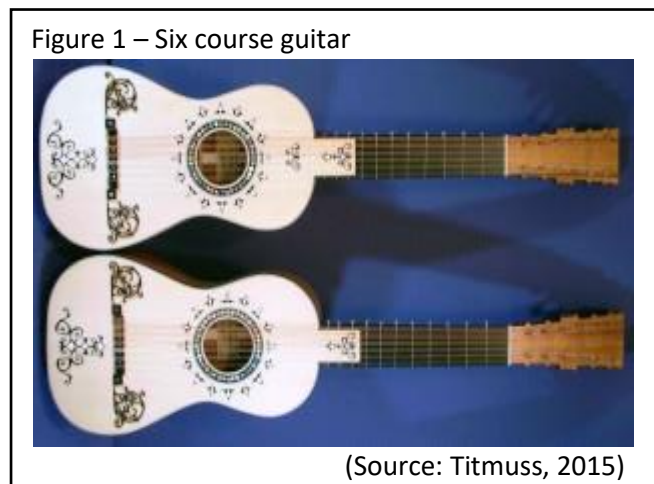
Its Challenges and innovation

Written by Li, Ka Shing Oscar
2019/4/9

The advancement in technology and material study had brought revolutionary development in instrument constructions. Harpsichord become Pianoforte allowing note to be sustained with a pedal, and better control over the dynamics. Brass functions better in the upper overtone, Vios become the modern-day string family. In the following research paper, we will be discussing the development of guitar, and the challenges luthier face in guitar construction today.

The Guitar Before Antonio de Torres

The earliest trace of guitar could be found during the Renaissance period. “Tres libros de musica en cifras para vihuela”, the earliest guitar score book written by Alonso Mudarra (1510-1580), shows that the guitar at his time was actually a four-course instrument (Tyler,1975). Due to the limited range of pitch the four-course guitar could provide comparing to the Vihuela and Lute of the family, a fifth course was added during the 17th Century. Later, the sixth course was introduced during the mid 18th Century (Turnbull, 2006). Up to this point, guitar is still very different from the modern-day standard. As shown in figure 1, guitar in the late 18th Century still uses the double stringed course, really slim body, a body-level finger board, and decorated with a lot of in-lays.



The development of guitar construction was never linear. Other from the most easily spotting difference of introduction of more strings, there are also varies kinds of innovation and alteration made to the guitar during the 19th Century. That’s included the introduction of a separate finger board, the new design of a bridge with a separated saddle, changing the woods

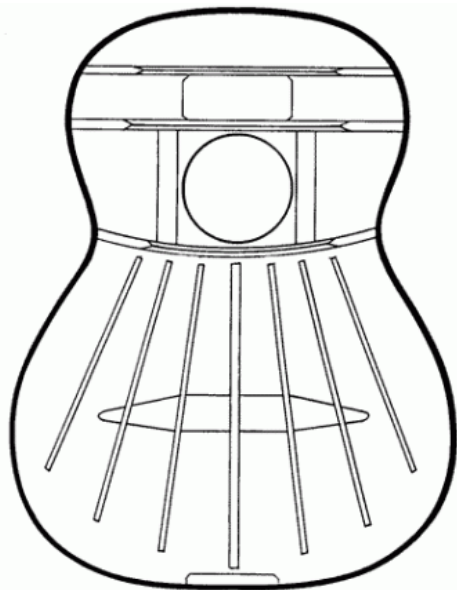
peg to a machine head, and the 12th frets. Among all of this little alteration here and there, one of the most important one is absence to the eyes as the alternation was made under the soundboard. Balancing the tension from the strings had always been a challenge for the luthier during the 19th Century. Transverse bars were added beneath the sound board to even out the tension, preventing the board being pull out. However, this reduced the flexibility of the table, affecting the efficiency of transmitting sounds. The fan bracing of Benedid and Pages, becomes the solution to the problem, freeing the vibration while providing sufficient supports to the table, balancing the tensions from the strings (Turnbull, 2006).

While there are a lot of innovative changes on the guitar, it was never standardized and still no where similar to the guitar today. For instance, a guitar in Spain during the early 19th Century may have six strings, compare to a six-course in Europe. Some guitar may have separate fingerboard that have 12 frets with a wooden peg, while some may be level with the soundboard and only 11 frets, but with a machines head tuning key. Until the Torres model, make by Antonio de Torres for the one of the most famous guitarists in history: Fernando Tarrega.

The standardise model

Antonio de Torres, is often seen as the father of the classical construction, his guitar is still a model, a reference for modern luthiers. According to Bergeron (2017), there are 10 innovations that Torres put together to make his guitar the modern-day standard. One of the challenge luthier face during the 19th Century, is that the growth of solo instrumental recital. The instrument is having to heard not just in chamber setting, but also in large venues like a concerto hall. The solution to the challenge is one of the biggest reasons why Torres' guitar become the standard. He understands that in order for the guitar to have louder size, it requires that there is

Figure 2 – Fan bracing



(Source: Bergeron, 2017)

more tone wood to vibrate. Hence Torres decided to increase the soundboard by 20 per cent, and reduced the thickness of the soundboard, as he realises that it might too heavy for the instrument to sound. However, this reduction in thickness made the soundboard too weak to withstand the tension from the strings. Here is why the fan bracing mentioned earlier becomes one of the most important innovation among the rest. Torres adapted the fan bracing and extended it to the bottom of the guitar (see figure 2) in order to allow the thinner soundboard to

balance the tensions (Moorish, 2002). The increase in sound board size give the guitar a more powerful sound, the reason why the Torres model become the standard. As Romanillos (1987) stated in the biography of Torres “From the moment that Torres introduced the large plantilla for the guitarra fina (best guitar) in the early 1850s, the small-bodied guitar prevalent in the early decades of the 19th century became extinct as a concert instrument.”

Other than the increase in size, Torres also adapted the lower bridge positioning and the bridge with separated saddle. Standardised the scale length as 650mm. He also restricted the use of ornamentation and inlays, as he thinks that the guitar is constructed for serious music, it should not be seen as a decoration or a household furnish. His adaption of the six strings, machine head, brass fret had become the standard specification of modern classical guitar but one thing: the material of the string. The innovation of guitar did not stop with Torres, in fact there are new creations today that tickles difference challenge guitar is facing.

Innovation never stops

Catgut strings used in the Torres model have issues in tuning and in the resonance of the bass. Segovia, the father of classical guitar, said he would be nervous and worried on stage because of his lack of confidence in the strings. Therefore, he had worked with the manufacturer to ensure the quality required of the strings is met. Later in the late 1930s DuPont invented and started the manufacturing of nylon. Albert Augustine started experimenting with the new material and asked Segovia to try the nylon strings. After the consultation with Segovia, and further amendment the nylon strings became the dominant choice, as its packaging was with a photo of Segovia, and a poem written by the master to praise the new invention (Small, 2018).

The trend of adapting new material had spread to the guitar body. The Dammann uses the Nomex, an aeronautical material also invented by the Dupont in the 1960s, to create the double-top guitar, where two skin thin of wood is glued to the Nomex creating a sandwich of soundboard. Greg Smallman on the hand work with John Williams, and used the carbon fibre as a bracing to support the soundboard. With the use of new material and a new structure design (see figure 3), where the soundboard is stuck onto a frame work while using the carbon fibre lattice bracing, the Smallman is able to reduce the thickness of the soundboard to paper thin, or as rumour said so thin that you can punch a hole on the soundboard with your finger (Dominelli, 2015; Cooper, 2002). Up until this point, all the adaptation of new material (brass fret in the early 19th Century, the nylon string and both of the new soundboard design) have an innovative approach, the change is purely aiming to make the guitar a better sounding instrument. However, some luthiers adapted the new material due to the lack of the traditional ones.

Rosewood for instance, had been a very common choice of tone wood for guitar maker, and Brazilian rosewood among other had been seen as a relic. However, the unique tone is not the major reason why it is so much of a gem to guitarist today, but its restriction of trade and scarcity of it. Rosewood is becoming an endanger species due to unsustainable harvest and extremely demand. The Conference on the International Trade in Endangered Species of the wild Fauna and Flora (CITES) had banned the trade of Brazilian rosewood in 1992, and further restriction on the trade of all rosewood had been applied in the Jan 2017. Due to this restriction, and the awareness sustainability raises, many luthiers start to explore new materials, more environmentally friendly options in guitar making. Bastien Burlot (an innovative luthier who build guitar with no sound hole, but two port holes on the side to maximise the soundboard vibration, hence the volume), for instance, started a new series called the MaestrO2, which have its back and side build with bamboo. He found the new material have a better acoustic and mechanical performance than the traditional wood used, thus a more sustainable option, as it emits 30% oxygen than tree and take less time to grow (Bastien Burlot, n.d.). Some mass production guitar brand also adopts new materials like carbon fibre.

There are still many of innovative design in guitar building, such as arm rests, raised fingerboard, zero fret, fan fret, and etc. We are limited to discuss the challenge each design is trying to tackle. Also, its very difficult to see the direction guitar is heading, since every luthier is doing their own design to differentiate themselves from one and other just like it was back in the early 19th Century before Torres made the huge steps in bring all significant design together. Also from the case of Torres and Tarrega, Sergio and the nylon strings, and the Smallman and John William, we can see that it is essential for the guitar developer to work closely with the performer to get the best result of guitar model.

Bergeron, K.A. (2017) 10 Classical Guitar Innovations from Antonio de Torres. *Classical Guitar*. Spring (2017) Retrieved from: <http://classicalguitarmagazine.com/10-classical-guitar-innovations-from-antonio-de-torres/>

Burlot, B. (n.d.). *Maestro: The new breath*. Retrieved from: <https://www.bastienburlot.com/en/maestro%E2%82%82/>

Cooper, C. (2002) The Future of Instruments. In J. Moorish (ed.), *The Classical Guitar - A Complete History* (pp. 84-85). London: Balafon Books.

Dominelli, M. (2015) *Bracing Styles for Classical Guitars*. Retrieved from: <https://www.thisisclassicalguitar.com/bracing-styles-for-classical-guitars/>

Moorish, J. (2002) Torres: Life & Work. In J. Moorish (ed.), *The Classical Guitar - A Complete History* (pp. 16-18). London: Balafon Books.

Romanillos, J.L. (1987) *Antonio de Torres – Guitar Maker – His life & Work*. Dorset: Element Books.

Small, M. (2018) Nylon (R)Evolution: Segovia, Augustine, DuPont, and the History of Modern Guitar Strings. *Classical Guitar*. Summer (2018). Retrieved from: <http://classicalguitarmagazine.com/nylon-revolution-segovia-augustine-dupont-and-the-history-of-modern-guitar-strings/>

Titmuss, C. (2015) *An overview of the six-course guitar by Clive Titmuss*. Retrieved from: <https://www.thisisclassicalguitar.com/an-overview-of-the-six-course-guitar/>

Turnbull, H. (2006) *The Guitar from the Renaissance to the Present Day*. Westport, CT: The Bold Strummer

Tyler, J. (1975). The Renaissance Guitar 1500-1650. *Early Music*,3(4), 341-347.