

A 20th Century Mario Maccaferri plastic ukulele / tremolo-‘Hurdy-Gurdy’ by SELCOL. Restoration and conservation.

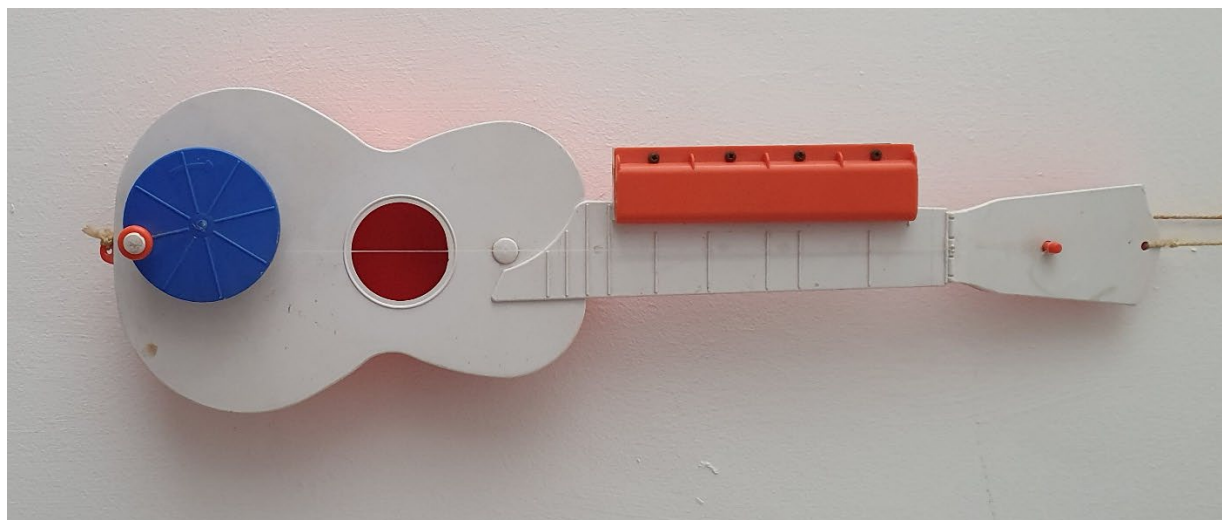


PLATE 1: Selcol one-stringed plastic instrument as found. (made c.late 1960's ?)

ABSTRACT

An unusual, possibly singular, example of a plastic¹ one-stringed instrument, combining features of a diatonic keyed dulcimer, hurdy-gurdy and a ukulele, was discovered in June 2022. Research suggests it may be a 1960's design prototype by Mario Maccaferri that was never manufactured. Its restoration and function are described and plastics conservation options are discussed.

INTRODUCTION

Mario Maccaferri (1900-1993)² developed his concept of designing and manufacturing good quality, affordable ukuleles, guitars and other musical instruments from plastic during the 1950's. He was a trained master luthier³, a highly skilled classical guitarist, music professor and inventor. He made a small fortune in the new plastics industry using injection moulding technology to produce utility products such as clothes pegs, wall tiles, fishing lures, clothes hangers and the like⁴. He successfully patented and marketed his plastic ukulele designs and his later 1960's 'The Beatles' sponsored plastic guitars and series of instruments were extremely popular and are now valued collector items. Maccaferri's manufacturing company MASTRO was in the USA, but Selcol in the UK was licensed to produce some of his designs that appeared under various brand, sponsor and product names⁵. Maccaferri retired in 1969 due to health issues. His designs, moulds, equipment and machinery were apparently sold at auction to Carnival industries of the USA, although the precise details and terms are sketchy. Thereafter plastic ukulele production seems to have ceased.

Maccaferri continued to design and co-produce stringed-instruments into his 80's. There are about 40 patents and registered designs to his name from 1932 to 1988.

DESCRIPTION

This previously unreported hybrid instrument appears to be a ukulele tremolo - 'hurdy-gurdy' based on Maccaferri's patented ukulele design of the 1950's⁶. It has the standard integral moulded 'Selcol' brand and 'Made in England'. Presumably, it was created using the same injection moulds or copies thereof. The differences are that there is only one string, an integral neck-mounted six-key mechanical attachment and a diatonic fretboard (**PLATES 1 & 5**). However, the original key array is missing. The string is activated, or rather repeatedly plucked, by hand-rotating a wheel whose underside has eight plastic plectrum 'fingers' spaced around its circumference (**PLATE 4**). The rotation speed is controlled by the player and melody achieved by pressing the keys at chosen frets.

The instrument loosely combines principles from a traditional hurdy-gurdy and the 'Smiths Patent keybox', as was fitted to late 18th century English Guitars. There are also some echoes of the 20th century instrument the *taisho goto*, a keyed dulcimer popular in Japan and India. The sound of this Selcol instrument approximates the continuous 'tremolo' effect, as heard on the classical guitar⁷, but single note melody lines are just about possible.

The main body components are most likely polystyrene, although the wheel material and its plectra are somewhat flexible, suggesting a different or modified plastic there, perhaps nylon or polyethylene.

Metal parts include a thin (10 thou, 0.25mm), stamped steel sheet of return springs (**PLATE 2**). The plate has eight spring 'teeth', suggesting it was intended to serve eight keys, but the diatonic fret layout only permits six. Other metal parts include the main wheel axle and fixing nuts and some screws securing the keybox assembly.



PLATE 2: Keybox cover and sheet steel spring bar with its 'teeth' springs



PLATE 3: Interior of keybox with spindle mounts and screw holes for spring plate and cover assembly.

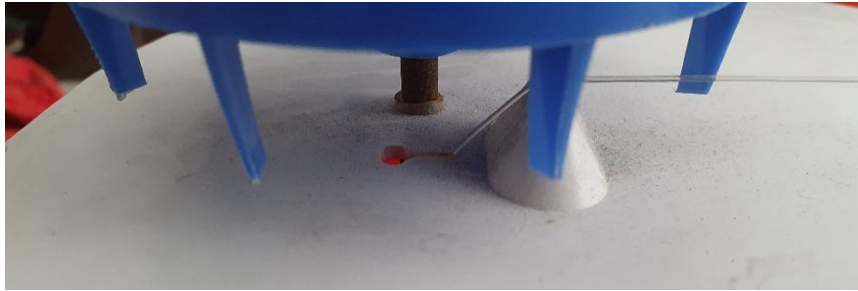


PLATE 4 : Underside of wheel with plectras. Axle, integral bridge and single string are visible

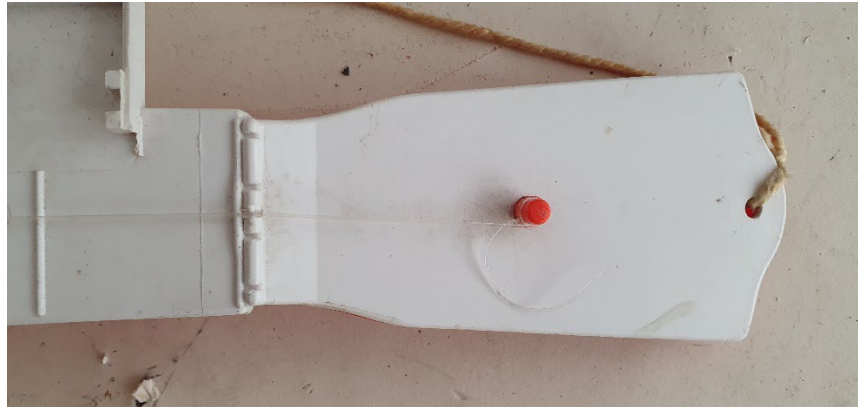


PLATE 5: Peghead with single string (note the zero fret and moulded string pathway)

RESTORATION

The original keys are missing and as yet there are no other known examples of the instrument for reference. However, by applying basic engineering knowledge and familiarity with the *taisho goto* I devised a suitable key form that works (**PLATE 6**).

The original keys were free mounted on a fixed spindle supported within the keybox allowing their individual movement downwards when pressed. The keys then automatically spring back to a return position when released. The key travel (distance when pressed) is about 2mm.

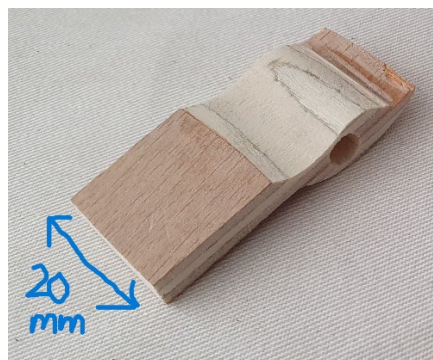


PLATE 6: Individual key unit with flat upper, 5mm spindle hole and 'ledge' at the back for return spring engagement

I used a 5mm diameter bamboo barbecue skewer as a spindle, fitted into existing cutaways at both ends and middle of the keybox interior moulding(**PLATE 3**). The six recreated keys are made from 5mm plywood, shape-formed by hand (**PLATE 6**).

The contact point of the keys on the string varies slightly along the fingerboard as the frets vary in width, but that variation was accommodated by using small leather pads suitably placed beneath the keys. I created a new return spring plate from 10 thou shim steel, as the original had rusted and was unstable. Reasonably accurate fitting of all the new components was required and after a few trials and adjustments the instrument was functional and playable. The string is plucked 15 mm from the bridge, accenting its higher harmonics⁸ and the plectra make a repetitive clacking sound as the wheel rotates, although single note plucking is possible. Informal experiments at softening the sounds using cotton wool wraps or loading the string with small pieces of masking tape were unsatisfactory.

CONSERVATION

Recreating and installing the keybox mechanism did not alter or compromise the original form and structure of this instrument, nothing original was cut away or removed. No attempts were made to 'improve' or modify the original concept⁹. No harmful adhesives, solvents or chemicals were used during the conservation.

Cleaning was carried out using de-ionised water on moistened cotton swabs. The recreated wooden key mechanism is completely removable, which will be done for storage of this plastic object. Re-installation for practical demonstration or display is possible. Dismantling the instrument's metal parts and storing them out of physical contact with the plastic will avoid any potential cross-interaction effects, such as rust staining or catalytic oxidation.

Most plastics degrade irreversibly through exposure to UV light, heat, atmospheric oxygen, local pollutants and temperature and humidity variation, as well as by self-destructive chemical processes due to their component substances interacting or dissipating (e.g. plasticisers, colourants). Many plastics, although apparently waterproof, actually absorb water, from humid air, condensation, or other source at their surfaces. That can cause swelling of the plastic polymer and then shrinkage, stress cracking or other physical changes upon repeated moisture uptake and drying out. Water may initiate or facilitate chemical reactions. Injection moulded plastic objects often have internal material stresses caused by the manufacturing processes of heat, pressure and rapid cooling. Such stresses can cause shrinkage, distortion or cracking later in the long term, especially in unstable storage environments.

Keeping plastic objects isolated¹⁰ in an oxygen-free atmosphere at low temperature and in stable relative humidity is a typical strategy for their conservation in museum storage facilities. Products such as Ageless™, packets and storage boxes use oxygen, moisture and pollutant scavenging sachets to control local environments¹¹. Silica gel cartridges 'programmed' to a specific humidity range are widely used¹². Nitrogen or other inert gas may be flushed into storage units to eliminate oxygen prior to gas-tight sealing. Unfortunately, if significant plastic deterioration has already occurred (see example **PLATE 7**) there are no easy restorative methods available, although research is current and ongoing¹³. The best option is to arrest and/or slow down whatever degradation processes are at work, but many plastic objects of the past are doomed to degrade and will be lost forever.



PLATE 7 : This cellulose acetate doll's face has suffered due to plasticiser out-migration and acetic acid vapours generated from the chemically degrading material itself¹⁴.

CONCLUSIONS

High quality plastic musical instruments enjoyed a boom from the early 1950's thanks to Maccaferri's efforts and his designs achieved great success commercially and culturally. This unusual, apparently undocumented, Selcol ukulele tremolo-hurdy-gurdy¹⁵ may be a one-off prototype or an experimental model that was never produced or marketed¹⁶, although the use of a specially designed injection mould suggests that other examples may exist.

It has no other label or markings to indicate a subsidiary brand or sponsor and it appears unfinished in some respects, as an experimental prototype might. This instrument would not pass safety criteria for a child's toy today, or even for adult use, without significant alterations. The wheel plectra come under repeated force and although flexible, would probably wear out or break after any longer term use. A curious child could easily demolish or damage the instrument during any kind of vigorous play. Storage options and protocols for this object and for plastics generally are available and are not cost prohibitive, but they may not be effective in the very long term. Some plastic objects will be lost forever, despite conservation efforts and plastic musical instruments is a category that merits our attention.

The acoustic output of this strange hybrid instrument is unmusical and harsh to my ears¹⁷. It does function, but is quite difficult to hold and play in a stable position. It is not really a finished performers instrument, but perhaps it would find a useful place in a sound-effects library or a composer's battery of sound-making objects.

Chris Egerton
London, July 2022

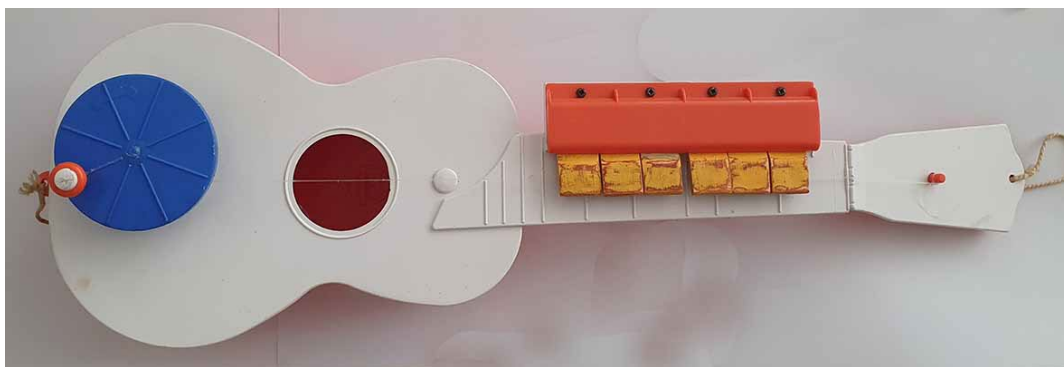


PLATE 8 : Completed instrument with six new keys

Bibliography

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https://www.getty.edu/conservation/publications_resources/newsletters/pdf/v29n1.pdf

Shashoua Y. '*Conservation of Plastics-Materials science, degradation and preservation*'. Butterworth-Heinemann. Oxford 2008. ISBN: 978-0-7506-6495-0

NOTES

¹ 'Plastic' here refers to thermoplastics that are used in injection moulding technology. They are normally sold as granules that are melted to suitable viscosity by heat and then pressure injected into steel moulds. Once cool enough the finished moulding is ejected and sent for further processing in the manufacturing chain. Mario Maccaferri invented and patented several improvements to plastics moulding and processing technology.

² Mario Maccaferri's fascinating life and work are detailed extensively on <https://mariomaccaferri.com/>. Accessed 30 June 2022. I am grateful to 'ukester brown' (David Remiger) at his website <https://www.ukesterbrown.com>, for that reference.

³ Wright M. '*Guitar Stories Vol. 2: The Histories of Cool Guitars*' Vintage Guitar Books USA 2000. Pages 183-229. ISBN: 1884883087

⁴ Simmons M. '*Clothespins, Castanets and Nine Million Ukuleles-Mario Maccaferri and the Plastic Uke*' in 'The Ukulele Occasional' issue 1, Summer 2002 p. 24-31. Jason Verlinde 2002 USA. ASIN : B0039H3OFO. Article licensed and available online <http://www.chordmaster.org/embed/uo-s2002-00.html>. Accessed 5 June 2022.

⁵ See for some examples <http://www.chordmaster.org/plasticukuleles.html>. Accessed 5 June 2022

⁶ Ibid 2

⁷ Maccaferri's lutherie and music teacher Luigi Mozzani used, developed and taught the tremolo technique that Maccaferri employed in his concert performances. A soundtrack of Maccaferri playing a Mozzani tremolo variation piece is currently available.

<https://www.youtube.com/watch?v=jTOtcmBEGT4> Accessed 30 June 2022

⁸ The string length of 345 mm and a plucking point at 15 mm gives us a 23rd harmonic as the dominant frequency emitted. For an ideal string with tuning of A4 (A4 is 440Hz) the 23rd harmonic is approx 10,000 Hz frequency. It's in the upper range of human hearing, and within the frequency range of audible bat calls. The thickness (0.65mm), stiffness and mass of the actual string and imprecision of the plucking mechanism will of course affect the final sound generated and heard.

⁹ An important ethical consideration for conservators is to preserve the artisan's original concepts, design and execution without alteration.

¹⁰ Some materials, such as modern fabrics, wood or wood composites, exude acidic vapours or other substances that can affect nearby objects and materials in long-term storage or on museum display. Care must be taken to assess and predict the interaction of any materials in proximity in such circumstances. Hence acid-free tissue paper wrappings, acid-free and buffered cardboard storage boxes, isolating vulnerable objects and materials, oxygen-free environments and maintaining environmental control over temperature and humidity.

¹¹ <http://ageless.mgc-a.com/applications/product/rp-system/#tab> Accessed 27 June 2022

¹² <https://www.preservationequipment.com/Catalogue/Conservation-Materials/Moisture-and-Humidity-Control/Proisorb-Humidity-Control-Cassettes> Accessed 27 June 2022

¹³ See bibliography.

¹⁴ From <https://manual.museum.wa.gov.au/conservation-and-care-collections-2017/modern-organic-materials/deterioration>. Fig 3. Accessed 3 July 2022.

¹⁵ The instrument has no official name although uka-hurdy, hurdy-lele, hurdy-uke were suggested by Lady Lovely Lute and Richard Mackenzie during a recent visit. Richard gave a convincing spontaneous rendition of 'Amazing Grace' on the instrument to our great delight and appreciation.

¹⁶ Antoine Carolus of <http://www.chordmaster.org/> is a significant authority on plastic ukuleles. He advised and commented that he has never seen this type of instrument and that its generally unrefined construction and appearance suggests a prototype or experimental instrument, or perhaps something produced by a Selcol employee as a fun project. Personal emails June 2022.

¹⁷ Ibid 8