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# THE ANCIENT GREEK KITHARA

Even though a number of organologists have written on the ancient Greek kithara in use from 650—450 BC (though this period has not previously been delimited quite so precisely), no satisfactory answers have yet been given to the questions of how it was constructed and how it functioned. The following brief summary of the conclusions reached in a study is intended as a contribution towards a solution of these questions.

## TERMINOLOGY

For the sake of brevity and clarity, I shall first mention the terms I use for the individual parts of the instrument. The hollow body of the kithara has two arms made of solid material that are fitted firmly into its two upper corners. The tips of the arms are part of the joints which link the arms with weights in such a way that the latter are movable. A crossbar passes through the weights; fixed to its two ends are discs and in the middle, between the weights, there is the tuning apparatus. I have given the term spring mechanism to a further mechanical system present in the instrument and situated beneath the joints, where it links the weights and their respective arms.

## THE INDIVIDUAL PARTS OF THE INSTRUMENT AND HOW THEY FUNCTION

The view that the weights and crossbar could be moved in relation to the arms and body has been expressed by other scholars[1], and, more im-

[1] Max Wenger: *Griechenland,* Musikgeschichte in Bildern, Band II: Musik des Alterums. Lieferung 4. Leipzig 1963, p. 114.

portantly, it is supported by depictions of the instrument in which the painter has not shown the various parts of the mechanical systems; these provide clear evidence of the way in which the kithara was constructed. The illustrations show the weights and crossbar as more or less separate from the arms, as though they were "suspended" in mid-air. Of the large number of iconograms available of the ancient Greek kithara in the years 650—450 BC, I have chosen only nine on which to comment here. More illustrations would offer nothing further of material importance, but merely reveal minor differences in details of construction; on the other hand however, they would serve to confirm the information provided by the illustrations I have chosen.

The ancient Greek kithara makers devised a number of systems for enabling the crossbar and weights to move in relation to the arms of the instrument. Judging from the dating of the iconograms in which type of kithara is shown, all of these systems seem to have been in use at the same time.

But first let us turn to a description of how the instrument and its individual parts functioned. The crossbar and the weights, attached at the joints to the ends of the kithara arms, were able to rock out in both directions from the vertical axis of the instrument. Whenever this happened, the crossbar, which passed through the weights in such a way that it could move, shifted a few millimetres towards the body of the instrument. This resulted in a temporary shortening of the strings (or rather a decrease in their tension), and had the effect of lowering their pitch. Depending on how far the weights were rocked out, the pitch of the strings could be lowered smoothly by almost three tones, which meant that the player could employ en endless number of tones ranging from the highest to the lowest pitched strings. The stability of the basic tuning of the kithara strings, i. e. when the weights were more or less perpendicular to the crossbar, was ensured by the continuous pull of the strings in the direction of the longer axis of the instrument as well as by the operation of the symmetrical spring mechanism linking the individual weights with their arms. The main function of the spring mechanism was to maintain this stability and to speed up the return of the weights to their original position after they had been rocked out.

Here it is necessary to explain how and when the weights could be rocked out, thus setting the whole system into motion. Basically there were two means of achieving this, each qualitatively different. In the first — the commoner, to judge by the iconograms — the player used his chin, nose or cheekbone to push against the disc fixed to the end of the crossbar, in this way moving it and the weights away from himself. At the same time, he kept the instrument in the same position relative to his body. At first the kinetic inertia of the relatively heavy weights would be too great for the force being exerted by the player, but once this had been overcome it would itself contribute to the smooth and relatively slow movement of the crossbar. When playing the instrument in this way, the kitharistes hat two possibilities. He could either shift the crossbar to certain points, thus producing precise tones (within the compass of the

instrument), or achieve a glissando effect by continuing to move the crossbar smoothly. At the same time, the spring mechanism and the continuous pull of the strings would act to return the crossbar to its position of rest. With the second method of playing the kithara, a tremolo could be created, with either very slight variations in pitch or larger vibrations covering a range up to approximately three tones. The speed of vibration of the tremolo would have been proportional to the range it covered: the less the variation of pitch, the more rapid the tremolo and vice versa. When using this method, the kitharistes would set the weights oscillating by moving the whole instrument at right angles to his body, in this way making use of the inertia of the weights, which would have a tendency to remain in their initial position. After they had been set in motion, the weights and crossbar would be kept moving by impulses from the impact of the spring mechanism, as well as by occasional movements of the body of the kithara by the player. Of course it would also have been possible to play the instrument without making use of the movable mechanism; in this case, it would have been played like the lyre, barbiton or phorminx (which, in terms of its construction, was the kithara's closest relative).

The most important part of the kithara, and the most difficult to construct, was the joint with its spring mechanism. The depictions of the spring mechanism are basically similar in all the iconograms, whereas there seem to have been a number of variants in the construction of the joint. The actual spring mechanism consisted of a flat spring in the shape of the letter U, as wide as the arm. At the base of the curve, it was fastened (probably with two nails) to the inner surface of the arm. This by itself would not have been sufficiently strong. To compensate for this, a second spring was added; it too was fastened to the arm of the kithara. This spring supported the lower part of the main U-spring, thus helping to prevent it from coming loose owing (ultimately) to the pull of the strings exerted indirectly through the weights. The weights rested on the U-spring through a device shaped like a small inverted rivet, whose head reduced the amount of friction on the surface of the U-spring when the mechanism moved. The spring mechanism had to exert the same pressure on the weights as was exerted on them by the pull of the strings in the tuning apparatus on the crossbar. This means hat the pressure exerted by each U-spring must have been equal to at least half the pull of the whole set of strings. Under these conditions, the spring mechanism would act to keep the whole mechanism in the position of rest and to return in there once it had been put in motion. It seems most likely that the springs and inverted "rivets" were alt made of hammered bronze. The supporting spring may have been riveted to the main U-spring, or simply wedged against a crimp at its end. Usually, however, it seems to have been riveted.

There were two joints linking the weights the arms, each of which had a number of variants appearing with roughly the same frequency in the iconograms. The picture shows how the tip or edge of the arm rested in a slot cut in the cylindrical pin inserted in the weight. If the angle

of the slot was greater than the angle of the edge of the arm, then the weigt would have been able to oscillate around the centre of rotation thus created. The surfaces of the slot in the pin would then act as edges limiting the degree to which the weight could rock out from the position of rest. Almost the same as this was a second type of joint that had its point of rotation in the actual body of the weight, under the pin in the vertical axis of the weight. Placing the rotation point of the joint here ensured that whenever the weights rocked out (and hence the crossbar moved) the pull of the strings would be reduced. The position of rest always meant the maximum pull, a condition attained by the other variants of the joint arrangement as well.

The second type of joint did not employ a cylindrical pin, but instead a more complicated system consisting of a flat bronze spiral fastened at one end to the top of the arm. The weight was attached on top of the spiral curve, its lower surface matching the curve of the spiral. At the same time, the top of the curve served the same function as the cylindrical pin in the first system. The maker linked the spiral with the spring mechanism, so that both formed a mechanical whole. Even greater functional sophistication was attained by a variant with a spiral joint, in which the centre of the spiral was firmly suspended on the tip of the arm. The lower surface of the weight followed almost the whole curve of the spiral and at the same time protruded to form a small "rivet" resting on the spring mechanism. Some iconograms show plates at the sides hiding the joint mechanism.

The curved shape of the arms of the kithara was fairly awkward from the mechanical point of view, and made the construction of the instrument more difficult. But besides the fact that this was a traditional shape, familiar from the lyre and barbiton, and probably determined by the natural shape of the original material (antlers), there was also a crucial functional reason for the curvature. If the arms had been set at right angles to the body of the instrument, there would not have been enough room for the strings between the two parts of the spring mechanism, since the two U-springs would have been touching each other.

Almost all the iconograms of the kithara indicate that the weights were made of some material that differed from that used in the rest of the instrument. They are differentiated either by colour (black, white, red) or, less frequently, by some other means of indicating a different material (for example, hatching). I imagine that they were made either of solid hardwood or of a number of pieces of ivory. Bronze would have been impossible: the weights would have been too heavy to function properly. But it is also possible that the protruding upper edges of the weights shown in some illustrations are meant to depict tops; this would mean that the weights were hollow. In this case, they might have been filled with something like sand, the amount of which could be adjusted according to the precise heaviness desired.

There still remain the crossbar with its discs and the tuning apparatus to be dealt with. In view of the relatively great pull exerted by the strings, the crossbar must have been made of some strong, rigid mate-

rial, but the iconograms give no indication of what this might have been. It must have been rather difficult to construct, since it had to be kept from twisting within the weights owing to the pull of the strings, and at the same time, when it moved vertically, there had to be enough friction, as it glied over the cylindrical surface of the firmly fixed pins or spirals, for it to put both weights into motion simultaneously. And the same was true in reverse; that is, the weights had to be able to move the crossbar back to its position of rest. I imagine that the simplest solution was to flatten the sides of the round crosbar where it passed through the weights. The sharp edge created where this flat section of the crossbar ended would prevent it from moving beyond a certain point and thus limit the oscillation of the weights. The disc at the one end served as a support for the player's head when the whole mechanism was put into motion. The disc at the opposite end enabled the kithara to be played by a left-handed player as well, and satisfied the need for symmetry. A number of iconograms show the discs replaced by other fittings attached at right angles, often shaped in such a way as to fit the player's head as neatly as possible.

The strings were tied around a strengthened part of the yoke. This type of tuning apparatus was common in all contemporary chordophones with a crossbar, and is still used today in many folk instruments — the Nubian kissar, for example.[2] It is interesting to speculate, since any twisting of the crossbar was reduced to the minimum, whether a tangential pull was created by the strings with regard to the crossbar. Several iconograms indicate that the tuning apparatus, on which the strings were wound, was not attached to the crossbar coaxially, so that the pull of the strings was almost on the same level as that formed by the prolonged axis of the crossbar and the edge of the bridge.

## HOW THE KITHARA WAS PLAYED

To complete this picture of the kithara in the years 650—450 BC, a description of how it was played should be given. It must be remembered that it was an instrument of considerable size and weight: the maximum heigt was around 1200 mm and maximum breadth 650 mm, and it weighed perhaps 10 kg or more.[3] In this period, the kithara usually had seven strings. When playing it, the kitharistes normally pressed the left edge of the body of the instrument and part of its left arm firmly against the left side of his chest, or made use of the curve formed where the body of the instrument joined the arm, fitting this up against his left shoulder. In some cases, when the instrument was particularly large, he also sup-

[2] Gwendolen A. Plumley: *El Tanbur — The Sudanese Lyre or the Nubian Kissar.* Produced by Book Productions Consultants, 125 Hills Road, Cambridge, p. 19.

[3] Leopold von Vorreiter: *Der Weissenbunberger Apollon mit Kithara.* In: Das Musikinstrument, Heft 10, Frankfurt am Main 1981, p. 1223.

ported the lower corner of the instrument with his left pelvis. To hold the kithara in position, he used a wide band, the telamon, which was attached to the lower part of the right arm of the instrument on one side and on the other passed around his left wrist and the lower part of his thumb and palm. The length of the telamon would have had to be determined very precisely, so that the fingers of the left hand could always move freely over the strings of the instrument. The right hand was free; in hit the kitharistes held a large plectrum (usually tied to the kithara), which be used to strum the strings above the bridge. He supported his head on the disc of the crossbar, so that whenever he wanted to he could set the weights in motion. If he wanted to create a tremolo, he would simply shift his heated slightly to one side, and so be able to move the whole instrument. With the fingers of his left hand, he could damp any strings that he did not want to sound after he had struck the set of strings with the plectrum. This technique is still quite common today in many folk chordophones in Africa, Asia and Europe — for example, the kantele in northeastern Europe.[4] This method of playing would also have allowed him to produce flageolet tones. Even when the instrument had more than five strings, it seems likely that the player could have allowed only one note to sound by damping two adjoining strings with a single finger. The iconograms do not seem to indicate that the plectrum was ever used to pluck individual strings.

## THE DISAPPEARANCE OF THE INSTRUMENT

The iconograms indicate that this particular type of kithara disappeared from the ancient Greek musical inventory after 450 BC. But the complicated system of oscillating weights and springs did leave a kind of trace in younger kitharas in the form of decorative arms recalling the silhoutte of the earlier spring mechanism. The weights vanished completely — all that remained was the elongated arms with crossbar at their ends. This was a partial return to the construction of the phorminx. It is unclear why the far more sophisticated kithara, with its weights, joints and springs, vanished. Perhaps it had something to do with the difficulty of playing the instrument, or a change in musical taste; here musicologists specializing in this period would be able to give a clearer answer. Or perhaps contemporary political and economic events played a role — and here historians might be able to offer an explanation.

[4] Irisa Priedite: *Eine Lettische Kokle.* In: Acta Musei Moraviae 1978 — Etnographica XII, p. 259.

## APPENDIX

The aim of this study was, as far as possible, to give an accurate interpretation of the available iconograms and to offer a theoretical description of how the instrument was constructed and played. These remarks are not meant to be taken as categorical assertions, but rather as suggestions for further discussion of this unusual instrument which, if my speculations are correct, would be the oldest partially mechanical instrument in the world known to us at present.

Kithara on vase from 480 BC now in the Museum of Fine Arts, Boston, cat. no 26.61