İDİL

MEASUREMENT OF KENAN ÖZTEN'S KANUN LEVERS

Serkan Mesut HALİLİ
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ABSTRACT

Kanun is a trapezoidal plucked string instrument that was redesigned in the early 20th century to include levers (mandal) transforming it into an essential Turkish musical instrument. Kanuns made in Turkey are mostly based on 72 equal temperament tuning with 72 equal tones per octave. For measuring the Turkish music pitches, kanun is more suitable than any other Turkish musical instruments because of their fixed lever system. In this article, all kanun levers of prominent luthier Kenan Özten's kanun have been measured and their average cents have been calculated. The objective of this article is demonstrating the kanun tuning process of Serkan Mesut Halili, calculating the average cent values of one-to-six lever changes and make them available for calculating the microtones of makam flavors. In Turkish music, makams are made of trichords, tetrachords and pentachords. Makams cannot be defined by scales. The main characteristic of the makams are their melodic progressions (seyir) and the flavors they use. Therefore, calculating the cent values of these flavors is a way to describe the exact values of microtones in makams. According to the measurements found in the research, one lever flattens the string by 17 cents, two levers by 35 cents, three levers by 51 cents, four levers by 69 cents, five levers by 85 cents and six levers by 100 cents which is a semitone. For the measurements, the advanced tuning software "Clear Tune" was used.

Keywords: Turkish music, Kanun, Makam, Kanun Lever Measurement, Microtone

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Introduction

In this article the tuning process of *kanun* player Serkan Mesut Halili is analyzed and the cent values of the levers of Kenan Özten's *kanun* are measured precisely. Kenan Özten (b. 1936) is a prominent Turkish *kanun* luthier who built the *kanun* analyzed in this article. The reason why this specific *kanun* was chosen is that Halili has been playing Turkish music and other genres of music with this *kanun* across the Globe for many years in various important ensembles such as Kudsi Erguner, Hezarfen, Burhan Öçal, Pera, Fazıl Say, Renauld Garcia-Fons and the musicians Halili is playing with are satisfied with these lever values for playing Turkish makam music. *Kanun*s made in Turkey are mostly based on 72 equal temperament tuning with 72 equal tones per octave (Yarman, 2008: 3; Günalçin, 2019: 7). "Is Özten's *kanun* based on 72 tone equal temperament?" question is tried to be answered in this article.

Tuning The Strings

There are different approaches to tuning the strings of a *kanun*. At the time of writing – early 2022- there are many *kanun* players tuning their *kanun*s from bottom string to the top with the tuner, tuning each string to 12-tone equal temperament. Prominent *kanun* player Ruhi Ayangil has a paper about his own tuning approach in six phases, based on Pythagorean tuning (Ayangil, 2012). In this article, Serkan Mesut Halili's method will be discussed. There are 27 three-string courses on Özten's *kanun*. The lowest one which is double-string course G is rare and custom-made for Halili. The strings are tuned as A, B, C, D, E, F# and G shown in Figure 1.

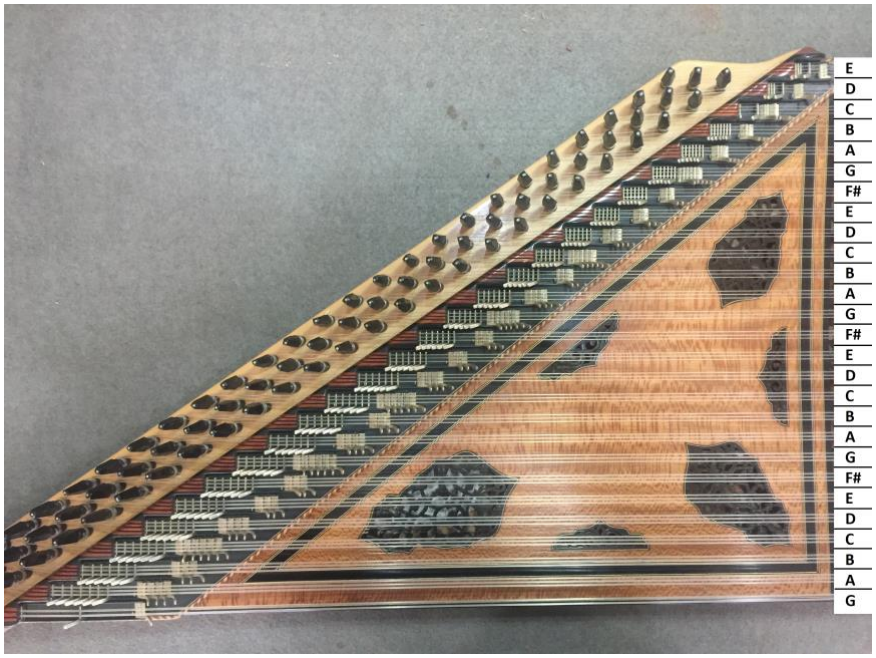

Figure 1: Tones of the *kanun* strings

At first, Halili tunes the third A from the bottom to 440 Hz. Then, he tunes the other three A's by checking the octaves without a tuner. The one octave lower A is tuned 1200 cents lower than A 440 Hz, two octave lower A (lowest note on the *kanun*) is preferred 7 or 8 cents lower. The same thing happens at the highest A which is 9 cents higher than the A 440 Hz. Halili prefers these deviations because he thinks the octaves only sound right with these adjustments. These satisfying octaves cannot be reached by using a tuner.

After tuning the A's, he tunes the E below A (440 Hz). From this point on, for each string he is tuning, he uses three methods: checking the tuner, checking the fifth interval between the related notes and checking the octave as a reference. He sometimes uses the second and third harmonics on the strings to check the tuning with the other strings. After he tunes the other three E's by checking the octaves as in tuning A's, he tunes the B below A (440 Hz). Then, he tunes the other three B's. After B's, he tunes the lowest F# and then tuned the other F#'s.

After F#'s, he tunes C below A (440 Hz) by using the tuner and then tunes other C's. After C's, he tunes G below A (440 Hz) by using the tuner and then tunes other G's. After G's, he tunes D below A (440 Hz) by using the tuner and then tunes other D's. In the end it is seen that the top six strings are tuned higher and the bottom five strings are tuned lower (Table 1). Halili said that only with these adjustments, he can hear the right octave between these high or low strings and their octave partners in the middle range of the kanun.

Levers (*Mandal*s)

'Number of Levers' column in Table 1 shows the total number of levers on each string. The reason for the two different numbers separated by an addition (+) sign is the default position of *kanun* levers. In the default position, the lever number on the left (outer levers) is always up. For example, A (440 Hz) has 6+4 levers. That means there are 10 levers on that string and in the default position, six levers are always up to achieve the note A. (Figure 2).

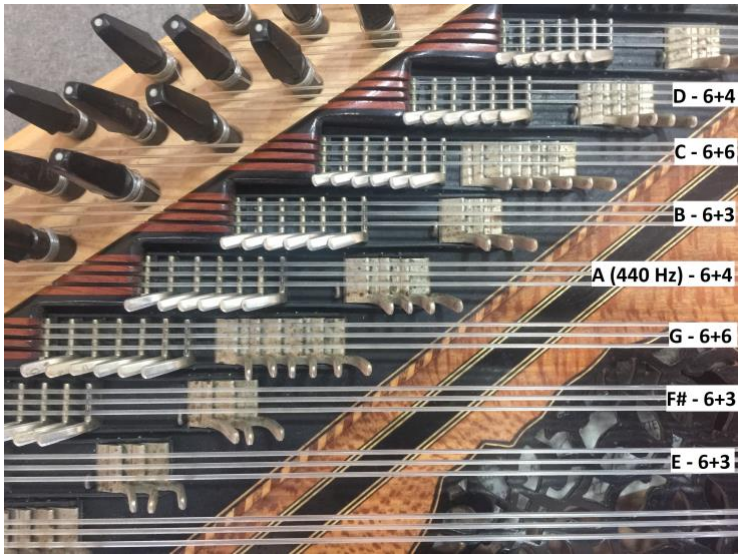

Figure 2. Levers on seven 3-string-courses

The default lever position and number of levers on each string is shown in Figure 3.

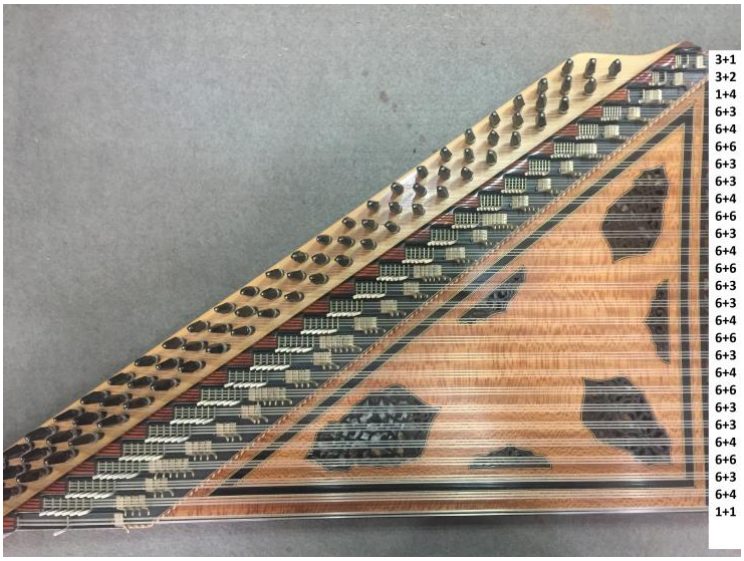

Figure 3. Default lever position and number of levers on each string

Aside from the top three strings and lowest string, all 23 strings have 6 levers up in the default position (Figure 1). These 6 outer levers show the name of the tones on the 'strings' column in Table 1. The top 3 strings and lowest string have less levers. The third column in Table 1 shows the cents of each lever change. The left side shows how much the outer levers lower the strings from the default position and the right side shows how much the inner levers raise the strings from the default position. To calculate the average cent of one lever change, the cent values on 16 strings' outer levers (left-side) are measured in Table 2.

Table 2. The cent values of one lever change on 16 strings' outer levers

Strings	F#	E	D	C	B	A (440 Hz)	G	F#	E	D	C	B	A	G	F#	E
1st Lever	19	17	15	18	18	18	17	18	16	19	18	18	15	18	18	15
2nd Lever	16	17	17	17	18	19	17	18	16	17	17	18	18	16	15	19
3rd Lever	15	16	18	17	15	16	16	17	18	17	16	16	17	16	16	16
4th Lever	19	16	18	17	19	17	16	17	17	17	18	17	18	18	18	18
5th Lever	17	19	15	16	15	15	17	15	18	17	17	17	17	18	15	15
6th Lever	16	15	19	19	17	17	17	15	15	15	17	18	18	17	18	17

As it can be seen, the range of one lever change is from 15 to 19. The number of occurrences is as follows:

15 cents: 15 times
16 cents: 16 times
17 cents: 30 times
18 cents: 25 times
19 cents: 9 times
Total Average: 16.791

This calculation proves that Kenan Özten is trying to use 72-tone equal temperament for his *kanun*s which has 16.66 cents per lever in theory. To calculate the average cent of two, three, four and five lever changes, the cent values on 16 strings' outer levers are calculated in Table 3, 4, 5 and 6 respectively.

Table 3. The cent values of two levers change on 16 strings' outer levers

Strings	F#	E	D	C	B	A (440 Hz)	G	F#	E	D	C	B	A	G	F#	E	Ave.
Two Levers Cents	35	34	32	35	36	37	34	36	32	36	35	36	33	36	33	34	34.625

Table 4. The cent values of three levers change on 16 strings' outer levers

Strings	F#	E	D	C	B	A (440 Hz)	G	F#	E	D	C	B	A	G	F#	E	Ave.
Three Levers Cents	50	50	50	52	51	53	50	53	50	53	51	52	50	52	49	50	51

Table 5. The cent values of four levers change on 16 strings' outer levers

Strings	F#	E	D	C	B	A (440 Hz)	G	F#	E	D	C	B	A	G	F#	E	Ave.
Four Mandal Cents	69	66	68	69	70	71	66	70	67	71	69	69	68	70	67	68	68.625

Table 6. The cent values of five levers change on 16 strings' outer levers

Strings	F#	E	D	C	B	A (440 Hz)	G	F#	E	D	C	B	A	G	F#	E	Ave.
Five Lever Cents	86	85	83	85	85	86	83	85	85	88	86	86	85	88	82	83	85.06

The average lever cents on Özten's *kanun* and theoretical cent values of 72 tone equal temperament are shown in Table 7.

Table 7. Average lever cents on Özten's *kanun*

Number of Levers	1 Lever	2 Levers	3 Levers	4 Levers	5 Levers	6 Levers
Average Cents	17	35	51	69	85	100
72 tone equal temperament	16.66	33.33	49.99	66.65	83.31	99.97

Conclusion

In this article, the tuning process of a kanun player Serkan Mesut Halili has been analyzed and the cent values of Özten's kanun levers have been calculated. One interesting fact about the tuning process is that the tuning of the top six strings is higher and the tuning of the bottom five strings is lower. The calculation of levers confirms that Özten's kanun like many other kanuns is very close to 72-tone equal temperament system and the average cent of a lever change is approximately 17 cents.

Table 1. *Kanun* Strings, Number of Levers and Levers' Cent Values

STRINGS (FROM HIGHEST TO LOWEST) (with cent deviations from 12TET)	NUMBER OF LEVERS (outer levers on the left + inner levers on the right)	LEVER CENTS	
E +15 cents	3+1	-60 -76 -98	+97
D +10, +11	3+2	-56 -75 -95	+94 +115
C +8, +9	1+4		+27 +48 +93 +111
B +10	6+3	-10 -28 -45 -63 -82 -100	+76 +94 +110

A +9	6+4	-8	+64
		-26	+80
		-43	+96
		-61	+113
		-76	
		-97	
G +8	6+6	-10	+26
		-25	+44
		-42	+63
		-60	+79
		-85	+96
		-100	+113
F# 0	6+3	-19	+65
		-35	+80
		-50	+97
		-69	
		-86	
		-102	
E 0	6+3	-17	+60
		-34	+76
		-50	+90
		-66	
		-85	
		-100	
D 0	6+4	-15	+52
		-32	+68
		-50	+85
		-68	+100
		-83	
		-102	
C 0	6+6	-18	+16
		-35	+31
		-52	+48
		-69	+65
		-85	+80
		-104	+95
B 0	6+3	-18	+70
		-36	+85
		-51	+100
		-70	
		-85	
		-102	
A 0 Frequency: 440 Hz	6+4	-18	+50
		-37	+66
		-53	+82
		-71	+98
		-86	
		-103	
G 0	6+6	-17	+17
		-34	+34
		-50	+51
		-66	+66
		-83	+82
		-100	+97
F# 0	6+3	-18	+65
		-36	+80
		-53	+97
		-70	
		-85	
		100	
E 0	6+3	-16	+65
		-32	+80
		-50	+94
		-67	
		-85	
		-100	
D	6+4	-19	+51
		-36	+65
		-53	+82
		-71	+99
		-88	
		-103	
C 0	6+6	-18	+16
		-35	+31
		-51	+49
		-69	+64
		-86	+80
		-103	+94
B 0	6+3	-18	+65
		-36	+80
		-52	+96
		-69	
		-86	
		-104	
A 0	6+4	-15	+52
		-33	+70

		-50	+85
		-68	+100
		-85	
		-103	
G 0	6+6	-18	+15
		-36	+30
		-52	+48
		-70	+63
		-88	+80
		-95	+96
F# 0	6+3	-18	+65
		-33	+80
		-49	+96
		-67	
		-82	
		-100	
E 0	6+3	-15	+60
		-34	+78
		-50	+91
		-68	
		-83	
		-100	
D -4, -5	6+4	-21	+42
		-37	+57
		-54	+71
		-71	+85
		-85	
		-104	
C -10, -11	6+6	-26	+7
		-42	+21
		-58	+37
		-74	+51
		-90	+67
		-116	+82
B -13, -14	6+3	-30	+55
		-46	+70
		-64	+86
		-81	
		-97	
		-116	
A -8, -7	6+4	-28	+40
		-44	+56
		-61	+71
		-79	+87
		-96	
		-114	
G -14, -15	1+1	-	+97

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