NEW VERSUS OLD: Playing-in Instruments through Vibratory Transmission of Music to the Bridge

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The authors vibrated several violins and a viola for 500 hours, by attaching a device to the bridges and playing an FM classical music station through it. Most players and listeners noted tonal changes and thought the changes were improvements.

The notion that old (particularly Italian) instruments have better tone and are easier to play than contemporary ones is widespread. Many comparisons of select old and new instruments have been made without any conclusive support for the view. In one recent comparison, the Tokyo String Quartet played some well known string quartet music with their own old Italian instruments (to which they were accustomed) and three quartets of modern instruments (to which they were not). The event was reported by Pickering (1994). The audience could see and thus possibly identify which of the instruments were being played and this may have been one of the many factors that influenced the outcome, one possibly favoring the old Italian instruments.

The music was, however, recorded by one of us (MK) and listeners were asked to identify the old and modern instruments from excerpts that were presented in random order through listening alone. One of us (DL) had a dozen experienced musicians attempt this auditory identification task and none was able to detect consistent differences between the old and new instruments. Most attributed their failure to the less-than-ideal quality of the recording rather than their auditory skills. The other (MK), however, was later able to identify almost all items on the test correctly from the same tapes.

The reasons for the apparent superiority in tone and playability of select old instruments is not known. Eban (1981) considered that it was due to their having been played on extensively and consistently, and noted that after being played for a while by a skilled player, an instrument is better than usual for a short time thereafter, but that an unplayed instrument will "go to sleep" even if the string tension has not been relaxed.

Hutchins and Rodgers (1992) point out that "violinists are well aware that continuous playing over a period of time tends to increase the ease of playing and the overall tone qualities of the instrument." They describe how one Jacob Augustus Otto, to speed an instrument's responsiveness, recommended its laborious bowing in fifths, each fifth for 1/4 hour daily over its complete range for a period of 2 -3 months. In contrast, they themselves described a method they had devised for playing a classical radio station through violins for 1500 hours by means of coupling loudspeakers (minus cones) to the bridge. They reported that, for the 12 instruments studied, the A1 mode frequency remained constant, but the B1 mode—and hence the A1-B1 Δ (see Hutchins 1989)—decreased an average of 22 Hz.

One of us (Killion 1994) later described changes with playing in the tonal qualities of his instruments—a 95 year-old violin and a modern viola—and suggested the possibility of producing a "closet violinist," an instrument that would vibrate the bridge in much the same manner as that described by Hutchins and Rodgers. One of us (DL), unknown to the other, had already employed such an instrument—one that used a bone conduction vibrator from an audiometer—and had found that audible changes in the tonal qualities of violins subjected to such vibration occurred in a matter of a few days.

Together, we decided to study the phenomenon more closely, obtaining not only tape recordings of a sample of radio music played through the instruments before and after vibration but pre- and post-vibration ratings from competent violinists on both the sound of the instruments when they were played by someone else and the ease of playing the instrument themselves.

The need to rate both tone and playability was suggested by the work of Chiang and Houtsma (1982) who had found that listeners were less able than the players to decide on ratings. This is a preliminary report since various constraints, including the difficulty in obtaining sufficient judges allowed us to vibrate only four instruments, two restored violins made 20 and 50 years ago respectively, one new viola and one new violin.

Method

The instruments were played and listened to, each by at least five competent string players, two or more of whom were professional musicians, who rated by them on a scale of 1-10. Each player understood that a rating of 1 would be given to the poorest instrument they had ever come across, a rating of 5 would

be awarded to an average instrument of acceptable quality, and 10 would be the rating given to the best instrument they had ever heard or played. The players rated the instruments twice, i.e., before and after the instrument had been subjected to 500 hours of vibration.

A Beltone 10 ohm B 70A Bone conduction vibrator (Radio Ear Corp, 1995) was used to vibrate each of the instruments. Its frequency response ranged from about 250 - 4000 Hz. It was coupled to the speaker output of a General Electric *Spacemaker* radio tuned to a 24 hour CBC FM stereo station. The vibrator was placed on top of the bridge, between the D and A strings, and was kept securely in place by means of two elastic bands that crossed around the instruments and over the top of the vibrator.

The radio was tuned to the station and the output level of the vibrator adjusted so that a strong vibration was felt in all four quadrants (back and belly). A brief sample of the introductory music (Respighi's *Ancient Airs and Dances)* from Bob Kerr's program, entitled *Off the Record,* was recorded at the start and at the end of the 500 hours vibration at this level.

The sample was recorded in stereo at a distance of three inches above the fingerboard near the *f*- holes using a Dual type 33-919A electret microphone and a Sony model UL stereo tape deck. The output from the vibrating violin at the microphone in this position was in the order of 95 dB. The pair of recordings obtained from each instrument were then dubbed onto another audiotape for play-back to an audience to demonstrate the marked differences between pre- and post-vibratory samples.

Results and Discussion

The results (Table 1) showed that the listeners/players were, with one exception (J for the viola) in close agreement on the sound and playing quality of the instruments. Ratings for the two restored instruments—both rated as being of moderate quality—support the notion that some such instruments in the hands of a good player sound better to a listener than they sound to another person when he/she is playing the same instrument. Comparisons of the pre-and post vibration period judgments suggest that the poorer the instrument at the outset, the more likely it is to be rated as improved following 500 hours of vibration.

Simple overall ratings (like other perceptual measures of stringed instruments) fail to tell the whole story. In this study, certain musicians clearly remembered specific things about particular instruments—how particular strings sounded, whether there was a completely even tone across or on certain strings, whether it was easy or difficult to obtain rapid changes in dynamic range, how quickly the instruments responded, and so on. However, while some such features were recognized by certain players or listeners they did not necessarily affect the rating. Judgments were more broadly based and reflected a gestalt impression.

All participants were sure that the instruments had changed, and most thought the changes were for the better. Two of the instruments were played extensively after the vibration period was over, the new violin by an advanced student and the viola by a professional in orchestral and solo performance. In both case, further changes in tone and playability emerged.

Many questions remain to be asked about vibration as an artificial means of playing-in an instrument. Does artificial vibration make trivial or truly important contributions to violin tone? To what extent can it promote in new instruments the qualities generally ascribed to older ones? What type of stimulus is optimal? Is the vibration provided by using an orchestra as the energy source more effective than using a recording of a single instrument or would driving the vibrator with a low-frequency square wave be as effective? What frequency response should an ideal vibrator have? What levels of vibratory intensity are desirable? What is the optimal duration of vibration? Is there an advantage in placing the vibrator on the side rather than on top of the bridge?

There is no doubt that frequency change such as reported by Hutchins and Rodgers (1992) occurs in wood that is vibrated. It occurs not just in violins at moderate humidity but, as reported by Hunt and Balsam (1996), in beams of spruce vibrated at high humidity. Do changes from vibration such as those reported here and elsewhere occur in all parts of the violin or in one plate more than another? Does it affect the glue as well as the wood? Does it affect the purfling and or the varnish? Should makers make allowances for the effects of later vibration on their instruments when they are making them?

Follow up on some of these questions might well prove to be useful, but the number of variables associated with each question is such that effective well controlled studies will prove to be difficult. Comparisons of input and output using a spectrum analyzer would potentially yield more quantitative data and, perhaps reveal more of the nature of the changes that occur with vibration over time.

Considerable further study of the topic is merited. ■ CASJ

REFERENCES

Chiang, C. J. and Houtsma, A. J. M. 1982. "A Comparison Between Expensive and Inexpensive Violin Strings," *CASNL* 38 (Nov.): 8-10.

Eban, G. 1981. "Musical Instrument Wood - A Luthiers View," *CASNL* 36 (Nov.): 8-10.

Hunt, D. G. and Balsam, E. 1996. "Why Old Fiddles Sound Sweeter," *Nature* 379: 681.

Hutchins, C. M. 1989. "A Measurable Controlling Factor in the Tone and Playing Qualities of Violins," *CAS Journal* vol. 1, no. 4, series II (Nov.): 10-15.

Hutchins, C. M. and Rodgers, O. E. 1992. "Methods of Changing the Frequency Spacing (delta) between the Air and B1 Modes of the Violin," *CAS Journal* vol. 2 no.1 Series II (May): 13 - 19.

Killion, Mead C. 1994. "The Effect of Extended Playing on the Tone of New Violins," *CAS Journal* vol. 2 no. 5 Series II: 22-23.

Pickering, Norman C. 1994. "Old Versus New Instruments at Cambridge," *CAS Journal* vol. 2 no. 6 (Series II): 39-40.

SOURCES

Radioear Corp. 205 Main Street, New Eagle, PA 15067. Tel. (412) 258 5353

Larry Revit makes a "closet violinist" vibrator. He may be reached at Box 528 Brownsville, VT 05037, telephone (802)484-5430 or fax (802)484-5718.

Table 1 - Judgments of playing and listening before and after 500 hours of vibration

Instrument 1 (DB)

	Pre-treatment		Post-treatment	
Players	Listen	Play	Listen	Play
L	6	5	8	7
K	6	5	7	8
P	6	5	7	6
A	6	5	8	6
D	6	5	7	6
Mean	6	5	7.4	6.6

Instrument 2 (RI)

	Pre-treatment		Post-treatment	
Players	Listen	Play	Listen	Play
L	5	5	6	7
K	4	5	6	7
P	5	4	6	6
A	5	4	7	5
D	5	4	5	6
Mean	4.8	4.4	6.0	6.2

Instrument 3 Viola

	Pre-treatment		Post-treatment	
Players	Listen	Play	Listen	Play
T	8	8	9	9
I	9	9	9	9
D	8	9	9	9
J	4	3	6	5
L	8	9	9	9
K	8	8	9	8
Mean	7.5	7.6	8.5	8.2

Instrument 4 (KT)

	Pre-treatment		Post-treatment	
Players	Listen	Play	Listen	Play
T	8	8	9	9
I	9	8	9	9
D	8	9	9	8
J	9	9	6	9
L	7	8	8	8
K	8	8	8	8
Mean	8.2	8.3	8.7	8.5