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COMPUTER-SUPPORTED JUDGING OF INSTRUMENTS AND BOWS

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At the conclusion of the Fifth International VSA Competition in Salt Lake City, and during the flight home to New York, Norman Pickering and the author discussed ideas to reduce the enormous complexity of data management to a more manageable level. With both of us having considerable experience in the use of computers, the potential usefulness became immediately apparent. From those initial conversations came the totally revised and computer-supported judging process that was exercised for the first time at Ottawa in 1984 during the Sixth International Competition.

Three key elements emerged as strong objectives for the new system:

1. Feedback to a maker that made visible the weaknesses and strengths of his product.
2. Strict safeguards to the integrity and anonymity of the judgment process.
3. The formulation of criteria that could be measured objectively and repeatably.

At the heart of the objectives was the goal to identify those instruments that sounded well and were built well and reward their makers with medals, while issuing certificates to those that excelled in only one of those criteria, tone or craftsmanship.

An initial program was written by Norman Pickering that was based on the revised score sheet, jointly developed by Pickering, the author, and many consultants who volunteered their valuable expertise.

It soon became apparent that a major programming effort was required to realize all the features that had been envisioned for the

judging program. In the following year, Steve Maring, an IBM engineer, volunteered much of his time to work with the author to rewrite and debug the required programs and prepare for a first test at the Ottawa convention. The IBM Company generously supported the VSA with an IBM Personal Computer for the duration of the convention and made people and supplies available as needed.

Much was learned in Ottawa that convinced the VSA board and members that this approach represented a major improvement over the previous process, and to support and encourage the continued improvements and development which will be discussed in the following pages.

Craftsmanship

The initial focus was on instrument craftsmanship and the identification of as many visual aspects of a maker's skill as could be practically judged. A list of twenty-five individual observations were distributed into five categories, each of them requiring an entry by a judge, giving them from 0 to 10 points. The averages for each of the five categories were then computed and summed up for the assignment of a total score. A copy of the instrument score sheet is shown in Figure 1.

The instruction to the judges asked for the assignment of a value of 5 for any average instrument observation, and proportionately larger or smaller values for instruments exhibiting higher or lesser skills, respectively. The judges were relieved of the paperwork burden by an assistant who completed, initialled, and transmitted each data sheet for computer entry in a remote location. In addition to facilitating the enormous judging process logistics, the availability of only one data sheet at any time assured a uniform, unbiased judgment for each instrument. Consultation between judges was not allowed. Consultation with the assigned assistant could take place to clarify rules of the competition.

The numbering scheme for all instruments and judges allowed traceability for each data point for later computer analysis. This feature was a valuable tool in determining the relative importance of each of the categories of judgment in the eyes of each judge in later data analysis. It also provided each maker with an opportunity to obtain clarification on points in his feedback report. In the weeks following Ottawa, two makers pointed out apparent discrepancies in their reports, which were traceable to wrong data entries. In each case corrections were made to the maker's report card and overall standing, and safeguards were built into the entry program to make such errors impossible in the future. The ability to review data and make corrections is in fact, by itself, a strong justification of this system. To accomplish similar results with a manual system would require extraordinary time expenditure without assurance of success.

VIOLIN SOCIETY OF AMERICA INTERNATIONAL COMPETITION OFFICIAL SCORESHEET

INSTRUMENT: VIOLIN VIOLA CELLO *(circle one)*

Identification Number: _____

TEST No	CATEGORY	SECTOR NUMBER	SECTORS	SCORE 0-10
1	Overall Impression	1	Weight and Balance	_____
2		2	Harmony of the Whole	_____
3		3	Character	_____
4		4	General Taste	_____
5	Fittings	1	Neck	_____
6		2	Fingerboard	_____
7		3	Topnut	_____
8		4	Saddle	_____
9		5	Bridge	_____
10		6	Pegs	_____
11	Design and Shaping	1	Outline of Body—Proportions	_____
12		2	Outline of Scroll—Proportions	_____
13		3	Arching of Back and Front	_____
14		4	Design & Placement of f-Holes	_____
15	Workmanship	1	Bending and Joining of Ribs	_____
16		2	Cutting and Shaping of Edge	_____
17		3	Purfling—Execution	_____
18		4	Harmony of Edge and Purfling	_____
19		5	Cut of Soundholes	_____
20		6	Cut of Scroll	_____
21	Varnish	1	Appearance of Wood	_____
22		2	Evenness of Application	_____
23		3	Consistency	_____
24		4	Transparency	_____
25		5	Color	_____

Judge Number: _____

Judge Initials: _____

Any erasures render this form void.

Figure 1

The score sheet for instrument craftsmanship was essentially contributed by Charles Beare of London, who was also one of the judges.

Analysis of Data

Immediately following the entry of all data, the computer, in a matter of minutes, had computed the total scores for all instruments and bows and started printing the makers' report cards. This process took approximately three hours, demonstrating the feasibility of giving a maker the competition results on the day following the judging and allowing an open report session on the last day of the meeting where summaries can be shown.

The total data base is much too large to incorporate into this article. Typical summaries for violin instruments are shown in Figures 2 through 7. Similar results have been produced for all instrument categories.

The analysis of instrument data points to some problem areas where improvements will be made; however, it is a surprisingly consistent data set between the three judges and is a strong argument for the validity of this method of judging.

The problems that were brought out by the computer related to the categories/sectors in the score sheet. It is evident, for example, that some of the sectors received little attention or judgment by the judges, indicating that the item was deemed of low importance and should be eliminated from future score sheets. Figure 8 shows the score distribution for "Fitting/Saddle." As can be seen, the judges were primarily concerned that the saddle "was there." The concern exists with all those categories where the judges used only a narrow spread of scores of the possible 0 to 10.

A further improvement is suggested from the excellent correlation between "Overall Impression" and the final workmanship scores. It appears that the judgment of some of the sectors in categories 2 to 5 is influenced by the initial impression a judge has of an instrument. Again, this phenomenon is remarkably consistent among the judges.

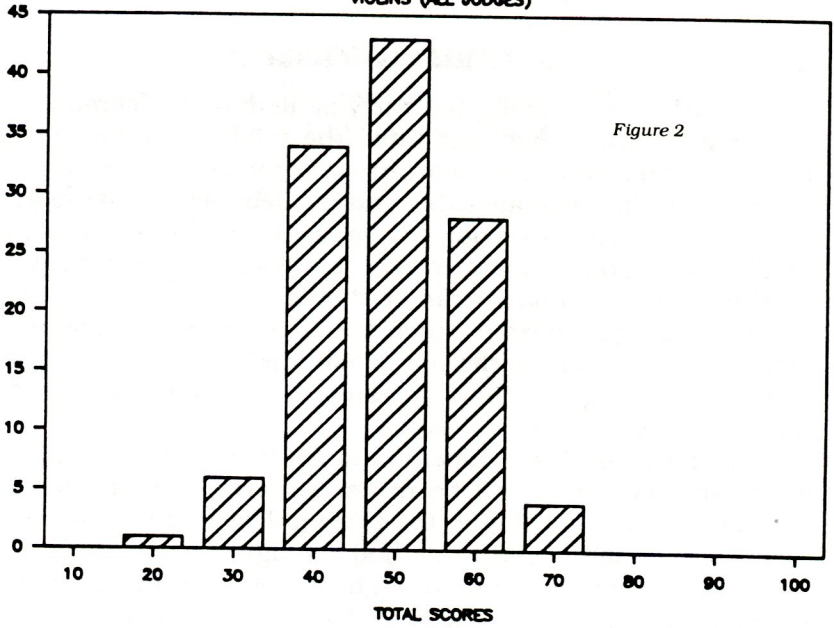
Some confusion was introduced by vaguely defined sectors. The "Varnish/Consistency" sector was interpreted differently by each judge as seen in Figure 9.

In discussions with the judges after the competition, some of the problems were already pointed out and suggestions were made. Among the most often mentioned problems was the lack of a category of "Setup," consisting of those parameters that relate to the "Playability" of an instrument. It was the consensus of the judges that the majority of instruments were improperly adjusted even though they were beautifully made.

Fatigue of the judges also surfaced as a major problem during the competition. Each judge was required to evaluate nearly 5000

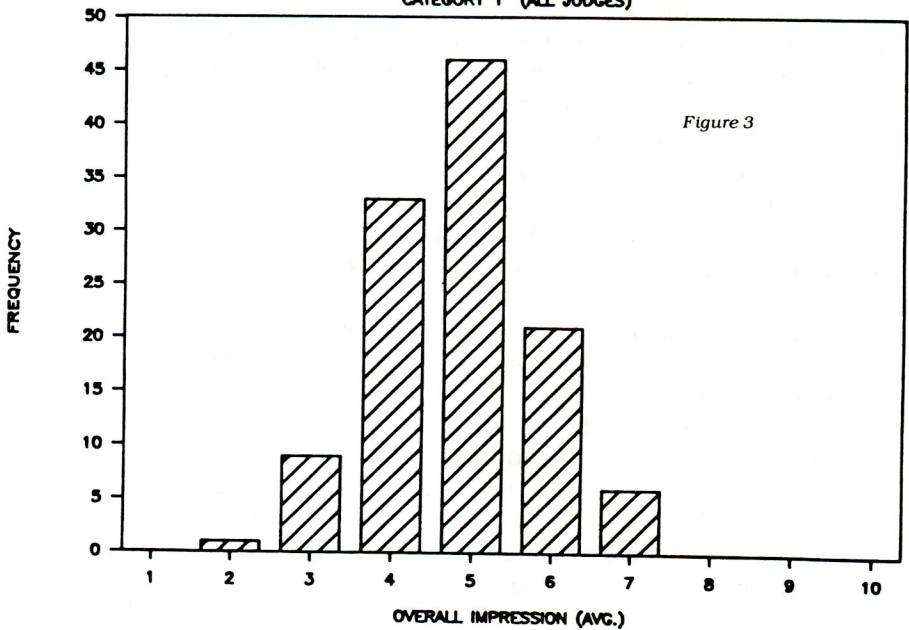
WORKMANSHIP SCORES

VIOLINS (ALL JUDGES)

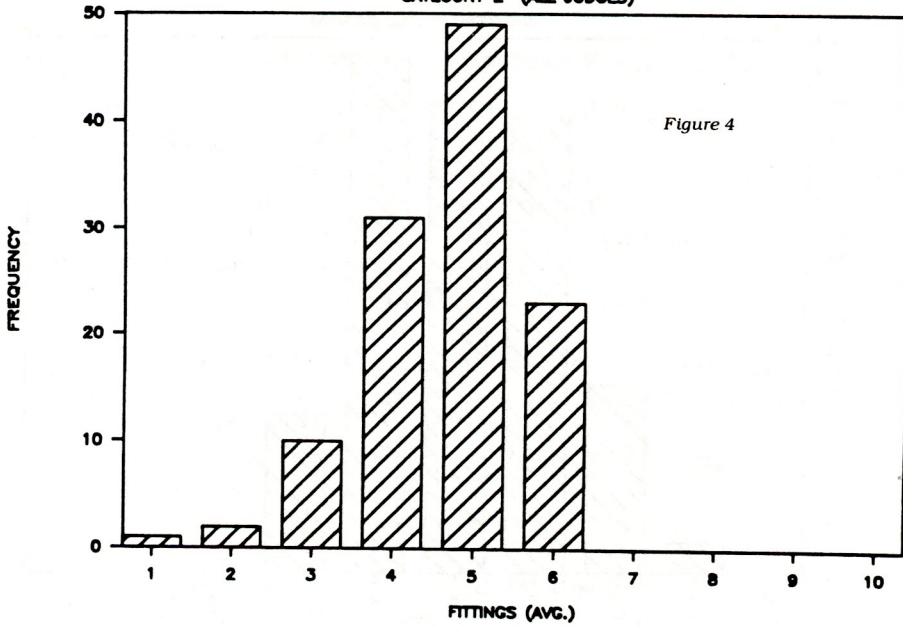


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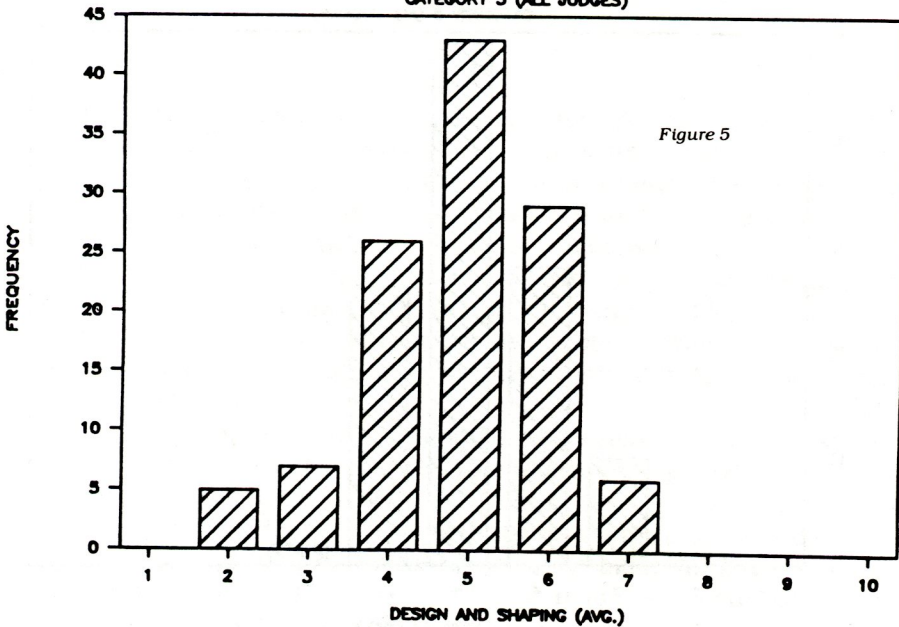
CATEGORY 1 (ALL JUDGES)



DISTRIBUTION OF AVERAGES FOR
CATEGORY 2 (ALL JUDGES)

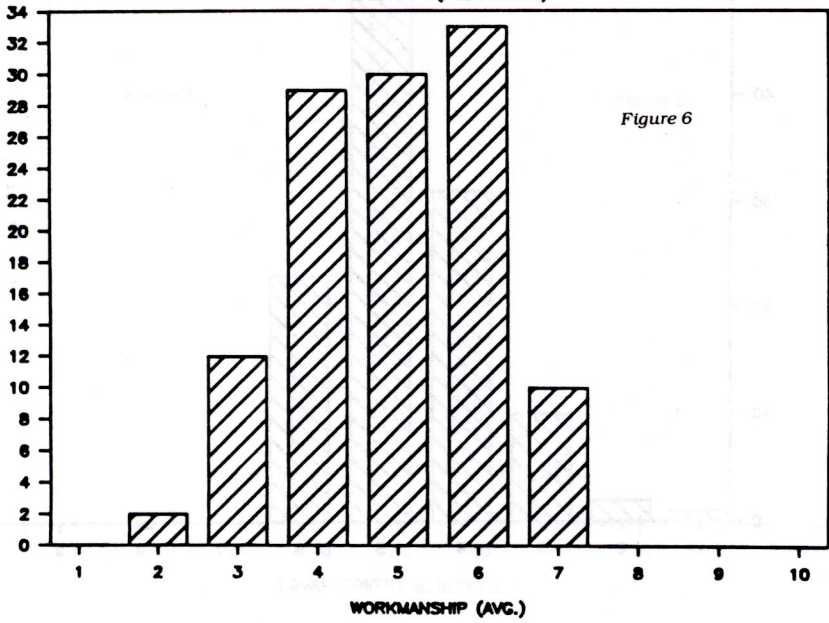


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CATEGORY 3 (ALL JUDGES)



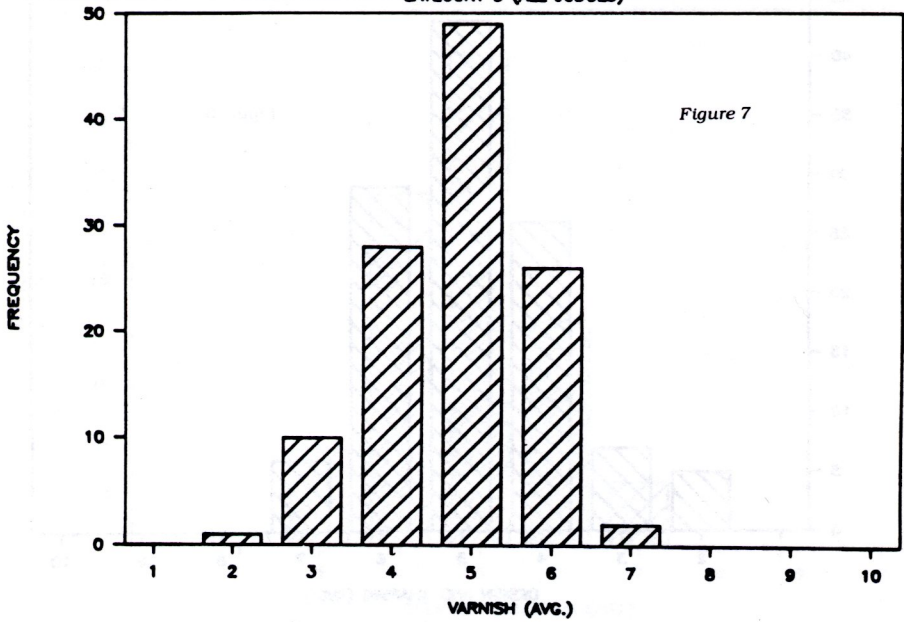
DISTRIBUTION OF AVERAGES

CATEGORY 4 (ALL JUDGES)



DISTRIBUTION OF AVERAGES

CATEGORY 5 (ALL JUDGES)



items over a period of two days. It is to the credit of the judges and their associates that this work was accomplished with such consistency.

Improvements to the System: Workmanship

The changes made to workmanship judging are best illustrated by referring to the new score sheet, Figure 10.

"Overall Impression" has been moved to the end to prevent initial biases to influence the judging of individual sectors.

"Setup" has been added, with sectors that relate to the playing parameters of an instrument.

"Character" and "General Taste" were combined into a single sector.

Four sectors were eliminated for lack of clear definition or relevance: "Appearance of Wood," "Consistency of Varnish," "Harmony of Edge and Purfling," and "Weight and Balance."

"Shape and Setting of Neck" has been added to the "Design and Shaping" category.

"Execution of Bridge" has been added to the "Workmanship" category.

Some changes were suggested by discussions with makers, judges, and players; others were clearly caused by the data analyses of the Ottawa competition.

The final worksheet was formulated in a workshop session with several members of the board of the VSA in July of 1985.

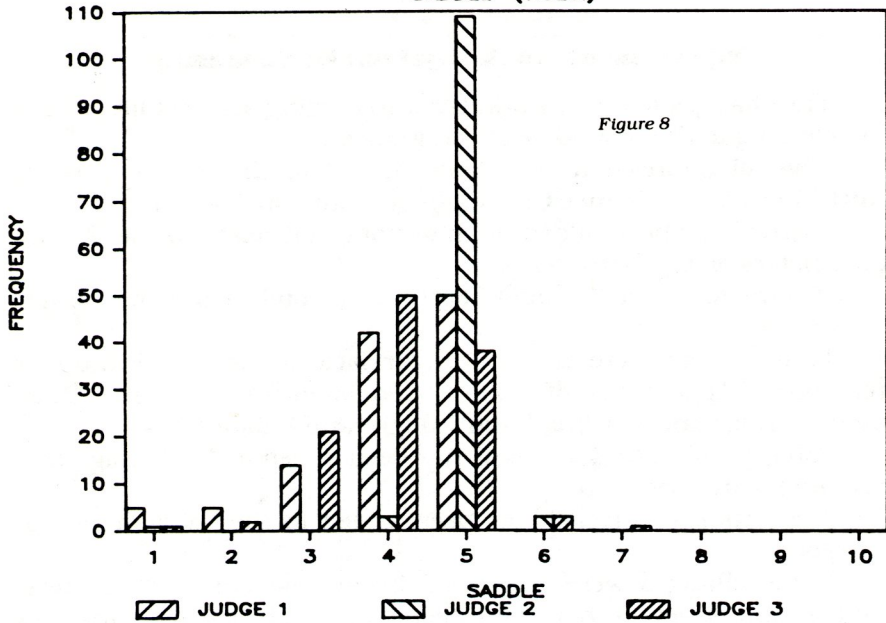
Tone

It is easy to understand that the assessment of tone quality of an instrument is more subjective than that of its workmanship. It is the lack of control of the playing environment, the player, the variability in auditory sensitivity, and the taste of the judge that contribute to the difficulty of obtaining "objective" data.

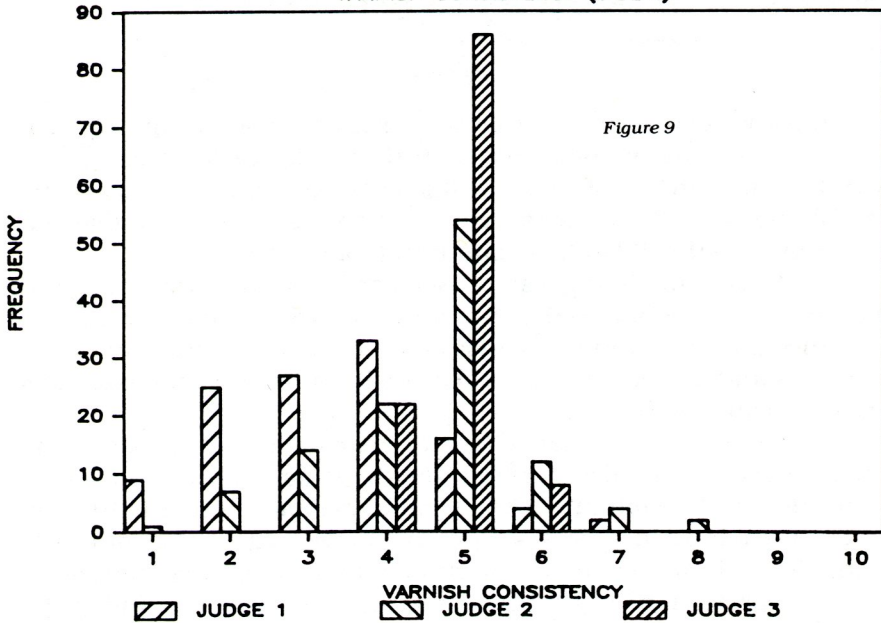
Statistics simply suggest an increase in the number of judges in proportion to the "subjectivity" to minimize this problem. While this is a nice paper solution, it is not achievable in practice for lack of facilities and judges and the enormous logistics problem associated with this approach.

The requirement that a "good" instrument must also sound "well" is most generally accepted; the dilemma is posed by a lack of definition and testability of what "well" means. If one further considers the relative degree of subjectivity between a playing judge who considers "playability" of an instrument and a listening judge determining "projection" of that instrument, it is easily concluded that the playing of an instrument is a better method of arriving at a figure of merit than listening, simply because the test environment can be better controlled.

DISTRIBUTION OF SCORES FOR SADDLE (MOLIN)



DISTRIBUTION OF SCORES FOR VARNISH CONSISTENCY (MOLIN)



VIOLIN SOCIETY OF AMERICA
INTERNATIONAL COMPETITION
OFFICIAL SCORESHEET

TEST #	CATEGORY/WEIGHT	SECTOR
1	SETUP (30%)	STRING SPACING
2		STRING HEIGHT
3		BRIDGE ARCHING
4		BRIDGE POSITION
5		UPPER NUT HEIGHT
6		UPPER NUT SPACING
7		TAILPIECE / SADDLE
8		FINGERBOARD PROFILE
9	DESIGN/SHAPING (20%)	OUTLINE OF BODY / PROPORTIONS
10		OUTLINE OF SCROLL / PROPORTIONS
11		ARCHING OF BACK AND FRONT
12		DESIGN AND PLACEMENT OF f-HOLES
13		SHAPE AND SETTING OF NECK
14	WORKMANSHIP (30%)	BENDING AND JOINING OF RIBS
15		CUTTING AND SHAPING OF EDGE
16		PURFLING EXECUTION
17		EXECUTION OF SOUNDHOLES
18		EXECUTION OF SCROLL
19	EXECUTION OF BRIDGE	
20	VARNISH (10%)	EVENNESS OF APPLICATION
21		TRANSPARENCY
22		COLOR
23	OVERALL	HARMONY OF THE WHOLE
24	IMPRESSION (10%)	CHARACTER/GENERAL TASTE

Figure 10

VIOLIN SOCIETY OF AMERICA INTERNATIONAL COMPETITION OFFICIAL SCORESHEET

BOW FOR: VIOLIN VIOLA CELLO BASS *(circle one)*

Identification Number: _____

TEST No.	CATEGORY	SECTOR NUMBER	SECTORS	SCORE 0-10
1	Overall Impression	1	Harmony of Line & Proportions	_____
2		2	Finish	_____
3	Shaping: Tip	1	Wood Sculpturing	_____
4	Shaping: Frog	1	Sculpturing	_____
5	Workmanship—Frog	1	Metal Parts	_____
6		2	Fit to Stick	_____
7		3	Screw Mechanism & Button	_____
8	Stick	1	Taper & Camber	_____
9		2	Wood Shaping	_____
10	Playing Factors	1	Balance	_____
11		2	Strength (Stiffness)	_____

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Judge Number: _____

Judge Initials: _____

Any erasures render this form void.

Figure 11

It was this reasoning that led to the tone-judging methodology that was adopted for Ottawa.

To be reasonably certain that an instrument possesses "good" tonal quality for medal consideration, it was required that all three judges found that instrument "acceptable." The judges were asked to consider if they themselves would play the instrument professionally, and, if the answer was affirmative, to assign a judgment of "acceptable."

When the computer had tabulated all results, only a small number of instruments had passed these stringent criteria. The tone judges then argued that they had been perhaps too critical, and they felt that the "unanimity" rule should be waived for this competition. In a meeting with all the judges, the VSA board then waived the requirement and allowed all instruments, which had been acceptable to at least one judge, to be considered in the medal round.

A recalculation of the results produced the winners which were announced. It is important to emphasize that anonymity was not compromised in these proceedings, since none of the judges or officials knew the identity of any of the instruments at that time.

When the winners had been determined, the tone judges returned to the ballroom and replayed each instrument with two of the judges listening to the playing judge. This test confirmed that the instruments picked by the computer were indeed of acceptable tone quality to award them a gold medal.

The most frequent question asked about the judging of instruments is the relative percentage value of craftsmanship and tone. There is, of course, no answer to this question in terms of what has been described. Since an "acceptable" tone had been a prerequisite for a medal instrument, before craftsmanship scores enter as criteria, it follows that they are at least of equal value. If a quantitative and precisely measurable test could be defined for tone judging, then one could establish meaningful "weighting factors" to account for the "relative worth" of tone versus craftsmanship. Perhaps the work of scientists and researchers will eventually establish the characteristics of a "good" instrument and ways to measure those traits.

Improvements to the System: Tone

The first factor to be addressed will be judge fatigue. It was obvious that additional time spent with the better instruments would improve the quality of the judgment where it was most important. To overcome this problem, the judges, independently, will give a brief tone test to each instrument to eliminate those which are clearly not worthy of extensive tone evaluation. Each instrument deemed acceptable by one judge will be admitted to the second round to be played further. The second round of testing will be open to the public, and will be performed by three playing judges

without possible identification of the instruments either by the judges or the audience. A tracking number will be announced for each instrument to allow the listeners to take notes for later identification.

The judgment of acceptability will be made by the playing judges only. It is the overwhelming opinion of those experts who were consulted that the subjectivity in playing an instrument is considerably less than in listening. In order to arrive at a fair judgment, a larger number of listening judges would be required. This increases the logistic and financial burden to the VSA far beyond the gain it would produce.

Those instruments that achieve unanimous acceptance from the judges will be eligible for tone certificates.

Quartets

When instruments were signed in at Ottawa, a special designation was made, identifying those that belonged to a quartet. The decision had been made to judge the four instruments (two violins, viola, and cello) as part of the normal population and to use the same data for determining the score for the placement of the instrument in the individual as well as the quartet competition. Unless specified by the maker, it was assumed that the first violin was the instrument to be considered in the individual competition.

The requirement for tone was acceptance of each instrument by at least one judge. The surviving instruments were then graded according to the workmanship scores they had achieved. No tone judging of the quartet as a group of instruments was planned. The individual tone scores were the sole criterion.

Bows

The judging of bows used a procedure analogous to that of the instruments; eleven sectors, falling into six categories, were judged. The score sheet is shown in Figure 11. The judges found the criteria clear and meaningful and the results reflected their feelings which had developed during the judging process.

Emphasis is on workmanship related to the various parts of a bow, with two factors related to playability. The difficulty discussed in the instrument section with devising tests for tone judging is compounded when considering playability of a bow. The preference of a player is even more pronounced since the bow is a mechanical extension of the player's arm and hand and must match a player's physique as well as playing style.

It was the opinion of the bow makers who were consulted that the general balance and stiffness of a bow are good approximations of the playing characteristics. It was with these inputs that the score sheet was designed.

As with the instruments, the category of "Overall Impression" will be moved to the bottom of the score sheet to lessen the potential for the early development of a personal bias which may affect the judgment of individual parts of the bows. No other changes are planned for this form.

Complete traceability of all tests is assured by the numbering sequence on the score sheet and the identification number that is assigned for the purpose of the competition.

Conclusion

As is evident from letters and conversation, the contributions made by computing methods to help expedite the evaluation of data and provide feedback to each contestant have been favorably received by the vast majority of VSA members.

The shortcomings of the programs used in Ottawa are well understood and are being corrected for Portland in 1986. It is hoped that each successive competition will bring about refinements to the program to improve various aspects after they are better understood. As scientists and makers discover new methods to evaluate instrument characteristics, the programs can be modified to reflect those findings.

This work is considered the first real attempt of its kind and aims to become a recognized standard approach to objective evaluation of instruments and bows.