

Player preferences among new and old violins

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Most violinists believe that instruments by Stradivari and Guarneri “del Gesu” are tonally superior to other violins—and to new violins in particular. Many mechanical and acoustical factors have been proposed to account for this superiority; however, the fundamental premise of tonal superiority has not yet been properly investigated. Player’s judgments about a Stradivari’s sound may be biased by the violin’s extraordinary monetary value and historical importance, but no studies designed to preclude such biasing factors have yet been published. We asked 21 experienced violinists to compare violins by Stradivari and Guarneri del Gesu with high-quality new instruments. The resulting preferences were based on the violinists’ individual experiences of playing the instruments under double-blind conditions in a room with relatively dry acoustics. We found that (i) the most-preferred violin was new; (ii) the least-preferred was by Stradivari; (iii) there was scant correlation between an instrument’s age and monetary value and its perceived quality; and (iv) most players seemed unable to tell whether their most-preferred instrument was new or old. These results present a striking challenge to conventional wisdom. Differences in taste among individual players, along with differences in playing qualities among individual instruments, appear more important than any general differences between new and old violins. Rather than searching for the “secret” of Stradivari, future research might best focused on how violinists evaluate instruments, on which specific playing qualities are most important to them, and on how these qualities relate to measurable attributes of the instruments, whether old or new.

tone quality | old Italian sound | subjective evaluation | music | perception

Almost all well-known violin soloists since the early 1800s have chosen to play instruments by Antonio Stradivari or Giuseppe Guarneri “del Gesu,” the two most celebrated craftsmen of the so-called Golden Age of violin-making (ca. 1550 to ca. 1750). A long-standing goal of violin research has been to correlate the playing qualities of these instruments with specific attributes of their physical structure and dynamic behavior, and yet “no [objectively measurable] *specification which successfully defines even coarse divisions in instrument quality is known*” (author’s italics) (1). Many factors have been proposed and/or investigated to account for the presumed tonal superiority of old Italian violins, including properties of the varnish (2, 3), effects of the Little Ice Age on violin wood (4), differences in the relative densities of early- and late-growth layers in wood (5), chemical treatments of the wood (6, 7), plate-tuning methods (8), and the spectral balance of the radiated sound (9–11). However, although correlations between violin acoustics and perception have been attempted (12), the fundamental premise of tonal superiority has not yet been properly investigated. Stradivari and Guarneri del Gesu may well be the greatest violin makers ever, but it takes an expert opinion based on visual and historical (rather than tonal) evidence to say whether a particular example is genuine. Playing and listening tests *never* enter the authentication process, suggesting the difficulty of reliably rating playing qualities—and that they may not correlate well with an instrument’s age and maker.

Weinreich (1) argues that any experienced player can classify a violin as a “student,” “decent professional,” or “fine solo” instrument; furthermore, “the judgment would not take more than about 30 s, and the opinions of different violinists would coincide

absolutely.” According to Langhoff (13), “any musician will tell you immediately whether an instrument he is playing on is an antique instrument or a modern one.” Neither of these hypothetical statements has been tested, and, apart from recent preliminary results (14), the research literature contains no well-controlled studies on how violinists rate violins or whether they can distinguish old Italian violins from old French or new American violins by their playing qualities alone.

In a recent wine-tasting experiment (15), subjects were given samples to taste while an MRI machine monitored brain activity. It was found that increasing the stated price of a wine increased the level of “flavor pleasantness” reported by subjects; it also increased activity in an area of the brain believed to encode for “experienced pleasantness.” Could a violinist’s preference for a Stradivari violin—and, indeed, the pleasure he or she experiences in playing it—be in part attributable to an awareness of its multimillion-dollar price tag and historical importance, both of which may be signaled by its distinctive appearance? Conversely, could the experience of playing a new violin be negatively affected by the belief that it is still centuries from tonal maturity? To avoid any such biases, we tested player preferences under double-blind conditions by using high-quality new violins together with distinguished “old Italians.”

Materials and Methods

The experiment took advantage of the fine violinists, violin-makers, and violins gathered in September 2010 for the Eighth International Violin Competition of Indianapolis (IVCI), one of the most important international violin-playing competitions. Six instruments were assembled: three new and three old. The new violins (N1, N2, and N3) were each by a different maker and were between several days and several years old. They were chosen from a pool of violins assembled by the authors, who then selected the three that they felt (i) had the most impressive playing qualities and (ii) contrasted with each other in terms of character of sound. One was a Stradivari model; two were Guarneri models. The old violins consisted of one by Guarneri del Gesu (ca. 1740) and two by Antonio Stradivari (ca. 1700 and ca. 1715). These violins were loaned with the stipulation that they remain in the condition in which we received them (precluding any tonal adjustments or even changing the strings) and that their identities remain confidential (hence the very general descriptions that follow). The earlier Stradivari (O1) was once the principal instrument of a well-known 20th century violinist and currently belongs to an institution that loans it to gifted violinists. It came to us from a soloist who had used it for numerous concerts and several commercial recordings in recent years. The later Stradivari (O3) is from the maker’s “Golden Period” and has been used by a number of well-known violinists for concerts and recordings. The Guarneri del Gesu (O2) is from the maker’s late period, during which he made some of his most celebrated violins. The combined value of the old violins is approximately \$10 million—roughly 100 times that of the new violins. Although the instruments were not all set up with the same strings, all had the very typical combination of a steel E with metal-wound, synthetic-core strings for the rest. All strings appeared to be in good condition.

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Numbers of subjects and instruments were small because it is difficult to persuade the owners of fragile, enormously valuable old violins to release them for extended periods into the hands of blindfolded strangers. Many of the 21 subjects were involved with the IVCI as contestants (four), jury members (two), or members of the Indianapolis Symphony. Nineteen subjects described themselves as professionals, 10 had advanced degrees in music, and 2 were later chosen as competition laureates. The subjects ranged in age from 20 to 65 y, had played violin for 15–61 y, and owned violins between 3 and 328 y old, with approximate values ranging from \$1,800 (US) to \$10 million (*SI Text*). Although we believe all subjects were sufficiently skilled for their preferences to be meaningful, we are aware that players with different levels of expertise may form their preferences on different grounds. This factor, however, is outside the scope of our study.

To attract participants, potential subjects were told that they would have the chance to play a number of fine violins, including at least one by Stradivari. No other information about test instruments, including the number involved, or whether they were old or new, was disclosed. Subjects were scheduled for individual, 1-h sessions, before which they were given instructions to read (*SI Text*) and a questionnaire and consent form to fill out. When trying out instruments, violinists typically use their own bows, which through constant use have become, in effect, extensions of their bow arms. In light of this practice, we asked subjects to bring their own bows. For the four who did not, a single good-quality bow was provided. Most violinists prefer to try out violins in a room with relatively dry acoustics, where the direct sound from the instrument is not so much colored by room reflections. Sessions were therefore conducted in a hotel room whose acoustics seemed well-suited to the task. We are aware that room acoustics may influence a player's preference for one instrument or another. However, that is a separate question not covered in this study.

Throughout the sessions, subjects wore modified welders' goggles, which, together with much-reduced ambient lighting, made it impossible to identify instruments by eye. To mask any distinctive smells, a dab of scent was put under the chinrest of each violin. The hotel room was divided into two areas by a cloth screen. To preserve double-blind conditions, violins were passed from behind the screen to a researcher wearing goggles, who laid them on a bed in the order received.

This study explores player preferences under two sets of conditions. One set, designed to maximize ecological validity, emulated the way players choose instruments at a violin shop, where they typically try a selection of instruments before selecting one to take home for further testing. All six test instruments were laid out in random order on the bed. Subjects were then given 20 min to choose (i) the single instrument they would "most like to take home with them" and (ii) the instruments they considered "best" and "worst" in each of four categories: range of tone colors, projection, playability, and response. These terms, all commonly used by players when evaluating instruments, were left undefined. If a term lacked clear meaning for a subject, he/she was told not to choose in that category. Although projection can, by definition, be judged only at a distance by a listener, players regularly estimate projection when testing a violin. They typically acknowledge (as did many of our subjects) the provisional nature of such estimates and the need to retest in a large hall with trusted listeners. Note, however, that our experiment was designed to test not the objective qualities of the instruments but rather the subjective preferences of the subjects under a specific set of conditions.

When making the best/worst selections, equal ranking between instruments was permitted (i.e., several could tie for best or worst), as was refraining from choosing. Subjects were free to play the instruments in any order and in any manner they saw fit, including switching back and forth among them. They were also encouraged to comment out loud about the instruments and selection process. A researcher made notes of the subjects' comments but responded to them only to confirm what had been said. At the end of the session, subjects were invited to guess the "making-school" of their take-home instruments—an indirect way of assessing their ability to distinguish new instruments from old ones.

Our second set of test conditions, designed with the statements of Weinreich and Langhoff in mind, asked subjects to assess instruments rather quickly. Each subject was presented with a series of 10 pairs of violins. For each pair, subjects were given 1 min to play whatever they liked on the first violin, then another minute for the second violin, without switching back and forth between them. The minute began with the first played note, including any tuning, and ended with the ringing of a bell. Subjects were then asked to state which violin they preferred. Unbeknownst to them, each pair consisted of a new and an old violin. Our set of three and three thus allowed for nine possible pairings. The order of the pairs—and of the instruments within each pair—was randomized to avoid presentation order effects. As a rudimentary

test for consistency, one of the nine pairs was presented twice. The retested pair was positioned randomly but with at least one other pair-wise comparison separating test from retest. The pair-wise comparisons were conducted at the beginning of each session and will thus be referred to as "part 1" of the experiment and the take-home/best/worst selections as "part 2." We believed that (i) part 1 should not be conducted after the subjects had played the violins for 20 min and (ii) part 1 was not likely to affect part 2 judgments because subjects were given no information about any (possible) relationships between the violins in parts 1 and 2.

Results and Discussion

When analyzing player preferences in part 1, we omitted the retests and considered only the primary nine pairs, where each instrument was played just once by each subject (*SI Text*). From these nine pairs, the mean number of times an old violin was chosen was 3.7. The two-sided 95% confidence interval (CI; all CIs are two-sided 95% intervals through the article) is [2.8; 4.5]. Although this interval leaves room for old and new to be equally preferred, equality is in itself a radical notion given prevailing opinions about old violins.

Table 1 shows the number of times each violin was chosen in each of the nine new/old pairings. In the six pairings not involving O1, the other five violins were chosen about equally often. By contrast, whenever O1 was paired with a new violin, it was chosen markedly less often. It seems that under these test conditions, only a conspicuously least-preferred violin differentiates itself. That violin happened to be a Stradivari (*ca.* 1700), and its consistent rejection appears to drive the overall preference for new violins seen above. We found no evidence that this preference was affected by the age of the subjects' own violin (*SI Text*).

Considering now the retested pairs, just 11 of 21 subjects (52%) made the same choice twice. The CI is [30%; 74%], meaning no firm conclusions about player consistency can be drawn. Note, however, that if subjects perform no better than chance in such a test, two possible conclusions might be drawn: (i) the instruments are about equal in overall quality (as suggested in Table 1), which means that forcing subjects to choose among them (in effect) forces random choices, where consistency cannot be expected, and (ii) subjects cannot choose consistently under part 1 conditions, which may therefore be unsuited to studying player preferences (*SI Text*).

In part 2, subjects were free to play any violin against any other, new or old, and to divide time between the instruments as they saw fit. Fig. 1 shows how often each violin was chosen as take-home choice (dark gray bar) and then as best or worst in four categories. Eight subjects voluntarily identified their least favorite instruments; these are shown in black beneath the take-home bar. Eight subjects had difficulty deciding which of two violins to take home: the times a violin was a close second is shown above the take-home bar in lighter gray.

In contrast to part 1, where five violins were chosen about equally, the violins now differentiate themselves more clearly. A single new instrument, N2, stands out as the most preferred: it was

Table 1. Number of times each violin was chosen in each of the new/old pairings

Pairs	New violin chosen	Old violin chosen	CI for old, %
N1-O1	15	6	[11; 52]
N2-O1	18	3	[3; 36]
N3-O1	16	5	[8; 47]
N1-O2	10	11	[30; 74]
N2-O2	10	11	[30; 74]
N3-O2	11	10	[26; 70]
N1-O3	11	10	[26; 70]
N2-O3	11	10	[26; 70]
N3-O3	10	11	[30; 74]

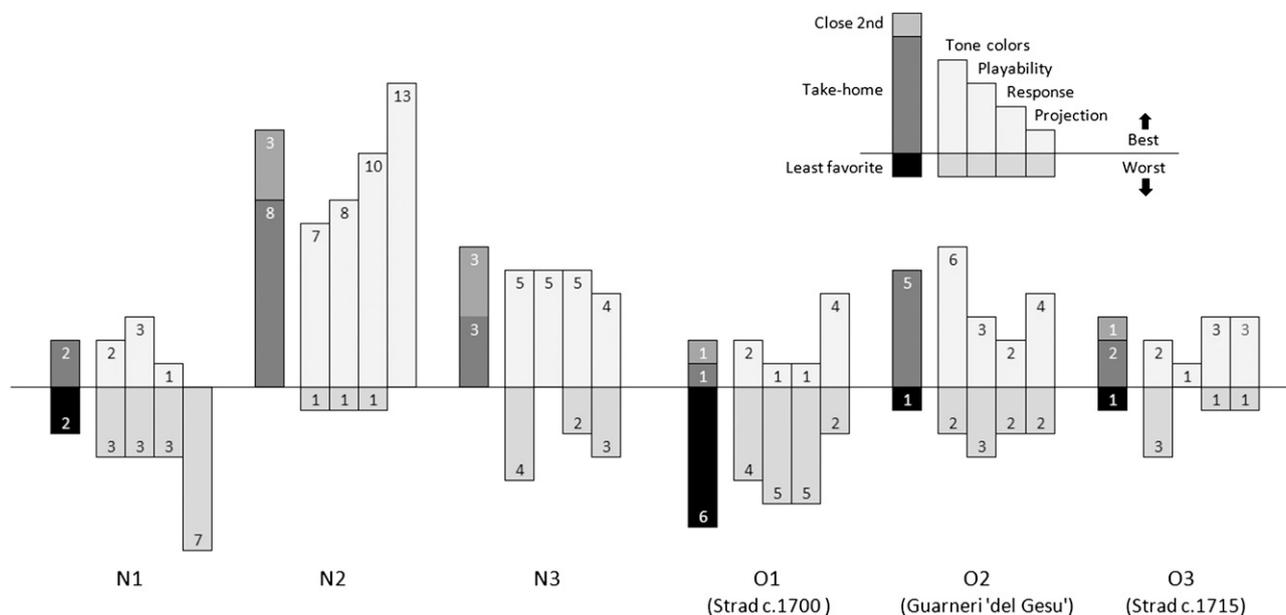


Fig. 1. Number of times each violin was selected as take-home and then as best or worst in four categories. Also shown are volunteered selections for close second and least-favorite (above and below take-home block, respectively).

chosen eight times as take-home, three times as close second, never as least-favorite, and just three times as worst-in-a-category. By contrast, O1 (*ca.* 1700 Stradivari) was chosen once as take-home, once as close second, six times as least-favorite, and 16 times as worst-in-a-category.

Although each violin was the take-home choice of at least one subject, four violins were also the least-favorite for at least one subject. This wide divergence in individual taste carries through into the four categories: With the sole exception of N2's projection, each instrument was chosen as best and worst at least once in each category. Unsurprisingly, each subject rated their take-home violin as best in at least one category (*SI Text*).

Just 8 of 21 subjects (38%) chose an old violin to take home. Given the small sample size, this disinclination toward the old cannot be confidently inferred to experienced violinists in general (CI [18%; 62%]). Still, the upper limit for the CI is not high; moreover, the fact that a new violin was chosen over examples by Stradivari and Guarneri del Gesu by 13 experienced violinists (including both jury members, who compared N2 and N3 favorably with their own Stradivari and Guarneri del Gesu violins; *SI Text*) stands as a bracing counterexample to conventional wisdom.

How consistent were the subjects? Of the 15 who chose new violins more often than old ones in part 1, 7 later chose old violins to take home. Against this, five subjects who chose old violins more often in part 1 later chose new violins to take home (*SI Text*). By this measure, just 9 of 21 were consistent—although this finding seems unsurprising given the way preferences shifted as time was spent with individual instruments (*SI Text*). What was consistent through parts 1 and 2 was a preference for new violins and a specific dislike for O1.

Can violinists tell new violins from old by their playing qualities alone? In coding the best/worst selections in the four categories, violins were given a score of +1 for "best" in a category, -1 for "worst," and 0 for neither "best" nor "worst". This coding allowed us to accommodate subjects who selected as many as six violins as "best" or "worst" (e.g., by saying "all are equally good") or as few as none (e.g., by saying "none are bad"). Because the scores range from -1 to +1, a difference of 0.50 is a huge effect and one of 0.33 is quite strong. Results are presented in Fig. 2.

Subjects rated new violins significantly more highly ($P < 0.02$) than old ones for playability and response, but no significant difference was seen for projection ($P = 0.62$) and tone colors ($P = 0.08$), so that uncertainty remains (*SI Text*). Asked about the making-school of their take-home instruments, 17 subjects responded: 7 said they had no idea, 7 guessed wrongly (i.e., that a new violin was old or vice-versa), and just 3 guessed correctly (*SI Text*). In light of this result, Langhoff's assertion (13) becomes difficult to sustain, as does the case for special playing qualities unique to old Italian violins.

This double-blind experiment is unique in studying player (rather than listener) preferences using new violins alongside distinguished old Italians. In a room chosen for its relatively dry acoustics, a preference for new violins was seen under two distinctly different sets of conditions. Under both sets, one particular Stradivari was the least-preferred instrument; under the second, a single new violin emerged as most-preferred. Subjects seemed not to distinguish between new violins and old but rather to choose instruments whose playing qualities best fit their individual tastes. It is worth noting that these preferences were based solely on the

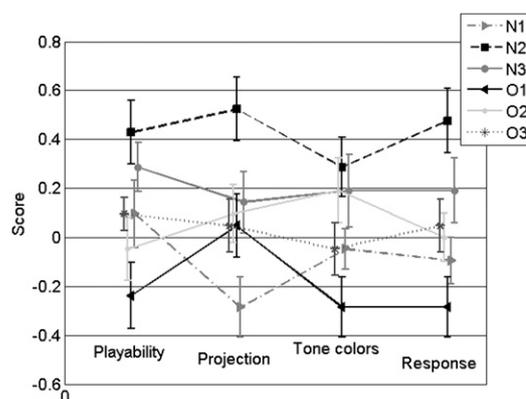


Fig. 2. Averaged scores of the six violins for the four criteria. The error bars correspond to ± 1 SE of mean.

experience of playing the instruments, meaning subjects heard them "under the ear" only and not at a distance.

Notwithstanding all of the above, the particular visual beauty and historical importance of old Italian violins will no doubt maintain their hold on the imagination of violinists and their audiences for a long time to come. This prospect comes through nicely in a comment by one of our subjects, an eventual competition laureate: When asked the making-school of the new instru-

ment he had just chosen to take home, he smiled and said only, "I hope it's an [old] Italian."

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