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The Weighting Game

By Larry Fine

ONE DAY IN AUGUST 1990, while practicing the piano, Laurie Orlov began to experience tingling and numbness in her fingers, accompanied by pain and loss of strength in her wrists, symptoms she knew to be characteristic of carpal tunnel syndrome. Orlov, a 42-year-old manager at a major computer firm near Boston and an accomplished, avid amateur pianist ("My husband calls it an obsession"), had only recently purchased a new Steinway B grand piano and begun studying with the noted pianist David Deveau.

"I tried everything," Orlov says, "doctors, wrist splints, ice, special exercises. I gave up playing Bach's *Goldberg Variations* and large Chopin pieces, dropped plans to learn the Schubert E♭ Piano Trio, and became more and more restricted in my playing. I was frantic, afraid that my life-long involvement with the piano was about to come to a premature end."

While Orlov nursed her wrists, her piano technician, Tony McKenna, nursed the Steinway, lubricating its action parts and voicing the hammers to make it louder (therefore requiring less pressure to achieve the same volume). None of these treatments—human or mechanical—seemed to help much. Finally, McKenna suggested calling in David Stanwood, a technician on Martha's Vineyard who is gaining a reputation for his ability to diagnose and treat grand-piano-touchweight problems. With the help of McKenna and an assistant, Stanwood took careful measurements, then returned to his lab to analyze the data with a computer program he developed. The result was a custom action re-weighting job that took into account both the piano's characteristics and Orlov's physical needs.

The difference was noticeable immediately, Orlov says, but now, six months later, she feels confident calling Stanwood's work "a real breakthrough."

She reports being able to play for extended periods of time, including many of the pieces she had previously dropped, without tiring or pain. Deveau calls the transformation "astonishing. When the piano was new," he says, "the action was much too heavy—even for an experienced professional. Now it's pretty close to perfect."

Such accolades are nothing new for David Stanwood, who has treated the pianos of Richard Goode, WGBH radio, Peabody Conservatory, the Boston Symphony Orchestra, the Manhattan School of Music, and many others. To understand what makes Stanwood's methods so unique, though, we must review the basics of grand-piano touchweight.

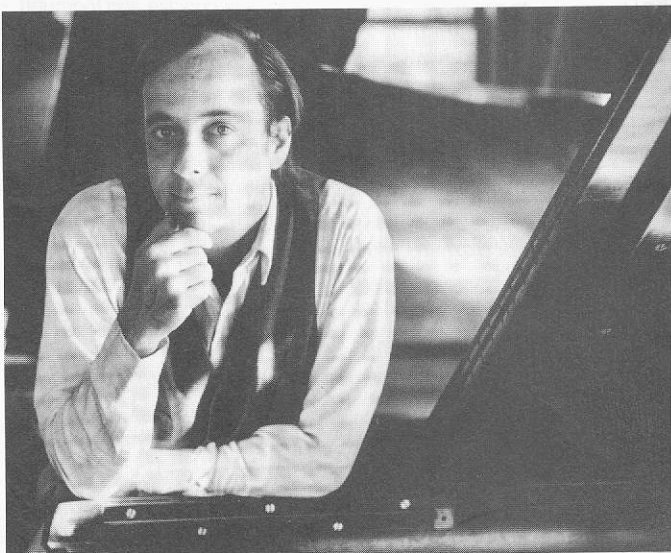
A piano key is like a seesaw, pivoting at its balance point, located behind the fallboard. The hammer and the other action parts all sit atop the back of the key; only the finger presses on the front. Because the weight of the action parts is normally too great for the finger to lift comfortably, lead weights are embedded in the front of the key to reduce the net weight to a more comfortable level. The force with which the finger must press to overcome this net weight (action parts minus key leads) plus the retarding force of friction is called *downweight*. The force with which the key returns when released—the net weight minus friction—is called *upweight*.

Virtually all measuring, adjusting, and discussion of

touchweight—in both the factory and the field—revolves around downweight and upweight. The heaviness or lightness of the touch is said to be expressed by the downweight, which normally averages between 45 and 55 grams. The upweight generally measures between 20 and 30 grams; less than 20 indicates a key that may be sluggish in returning, usually because of excess friction. The problem with specifying touchweight with these measurements, however, is that downweight and upweight are measured with the key moving very slowly, whereas at the key velocities with which most playing takes place, these touchweight elements become insignificant, overshadowed by a much larger and entirely different force: inertia.

Inertia is the tendency of matter at rest to remain at rest and for matter in motion to remain in motion at the same velocity and direction unless acted upon by another force. An object's inertia varies in proportion to its mass and its velocity. The critical distinction between, on the one hand, an action's touchweight as measured conventionally and, on the other, its inertial properties is that the former is dependent on the *net* weight between the action parts on the back of the key and the key leads in the front, whereas the latter is dependent on the *total* amount of mass set into motion.

For a practical demonstration of this distinction, consider the following scenario: a piano that plays nicely with a downweight of 50 grams is being rebuilt. The rebuilder replaces the old hammers with new ones that are a little heavier. To compensate for the extra hammer weight



Alison Shaw

WEIGHT MANAGER: David Stanwood devised a new computer-based technology to come up with solutions to baffling action problems.

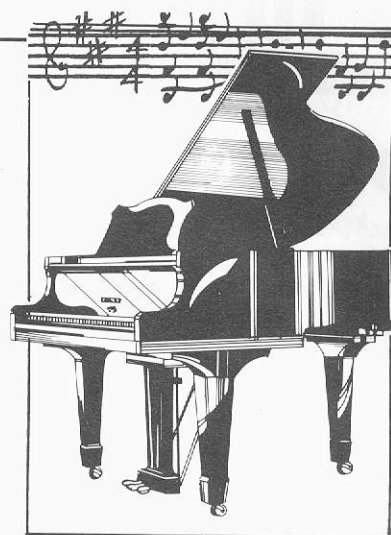
and retain the original downweight, the rebuilder places some extra key leads in the front of each key. When the rebuilt piano is delivered to the customer, however, she complains that it plays "like a Mack truck." The rebuilder is perplexed because, after all, the downweight still measures 50 grams. Perhaps he just shrugs and says "it's in the piano," leaving the dissatisfied customer to fend for herself. Or worse, he adds some more key leads to "lighten" the action; although the downweight measures "lighter," the keyboard actually feels heavier to play than ever and the keys return sluggishly, too.

The scenario above is a common one. The mistake the hapless rebuilder made is that in "compensating" for the heavy hammers with extra key leads, he actually doubled the amount of extra mass in the action, greatly increasing its inertia. In addition to feeling heavier, keys with too much inertia will not reverse direction quickly; they will feel unresponsive and the pianist's fingers will tend to lose contact with them. Hammers with too much inertia may not rebound quickly enough, possibly damping some of the harmonics that give color and brightness to the tone. Although these relationships have long been known to experienced technicians, until Stanwood's recent work it has not been possible to measure quantitatively and then to calibrate an action's inertial properties; so, to a large extent, these properties have simply been ignored.

Stanwood's work has taken interesting turns as it has evolved over the years. Initially his focus was on controlling action friction. To that end he invented a hammer flange whose friction could be easily adjusted to compensate for seasonal changes in humidity or to accommodate a variety of touchweight preferences.

Gradually, Stanwood began to realize that finesse in controlling friction, though important, did not address the most significant issue. Of particular concern to him was that manufacturers seemed to be untutored (or lazy) in weighing off keyboards and were using key leads indiscriminately to compensate for variations in friction, presumably leading to large and random variations in inertia from key to key. Using the standard formulas for touchweight, Stanwood separated the component of touchweight due to mass from that due to friction and coined the term "balance weight" for the former. Stanwood rea-

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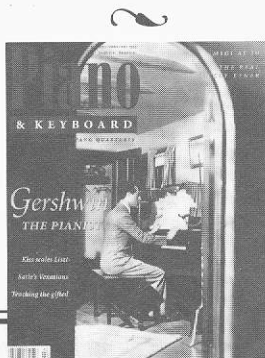
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soned that although he could not yet measure inertia directly, balance weight could be used as a stand-in for it; that is, if the balance weight were consistent across the keyboard, likely the inertia would be too. He then devised a method for weighing off keyboards (the "balance-weight system") that, in fact, produced that result.

But making the balance weight uniform turned out not to be good enough either. "It's the occasional keyboard that doesn't respond to my treatment that forces me to a new level of understanding," Stanwood admits. Challenged by actions whose overall level of inertia, though uniform, was grossly high or low, Stanwood invented "a new technology" (a patent for which is now pending), including a computer program and new measuring devices, to measure, calculate, and adjust an action's inertial weight.

Stanwood has been developing a nationwide business devoted to action improvements, based on a network of "Stanwood Action specialists" who refer work to him. Typically, a pianist unhappy with a piano's action contacts the nearest Stanwood-trained technician, who in turn takes careful touchweight measurements, makes note of the pianist's special requests or requirements, and sends all the information to Stanwood, who runs the data through his computer. The computer displays the action analysis in the form of several graphs, which Stanwood reviews for clues to the cause of the pianist's discontent. As many as 20 touchweight components are identified in each key, giving a complete picture of the friction, weight, inertia, and leverage in the action. Stanwood recommends possible courses of corrective work, which the local technician explains to the customer. The keys, and if necessary the action, are shipped to Stanwood, who does the work and sends them back. Finally, the local technician reassembles and reinstalls the action and performs regulation and voicing as needed.

Stanwood prescribes several kinds of corrective action. All keyboards receive "inertial balancing," Stanwood's term for his brand of key-weighting that takes into account the action's inertial properties. On some pianos, he says, this is all that is needed. Pianos that would otherwise require excessive amounts of key lead to achieve a normal touchweight are instead outfitted with whippen support springs. These springs, which makers as

fine as Bechstein and Bösendorfer have used, provide "lift" to the action parts, thus reducing their net weight without adding mass. Stanwood's original invention—variable-friction hammer flanges—are an option for those who want the finest level of control, he says, especially for concert instruments that are maintained frequently. One of Stanwood's optional procedures that is sure to be controversial is his adjustment of hammer weight by inserting lead in the moldings. Most practitioners prefer to lighten hammers, for reasons of both tone and touch, but Stanwood has found that the tone often benefits from the opposite, especially on larger instruments. As a last resort, some actions may require alteration of their geometry and leverage through repositioning of action parts.

An interesting consequence of the quantitative nature of Stanwood's work is its unusual adaptability to a pianist's requirements. "If a pianist owns Piano A but wants it to feel like Piano B," Stanwood says, "I can measure B's action characteristics and come pretty close to matching them." Stanwood keeps an extensive database of measurements from pianos that good pianists have said they like, so he knows the ranges that should be considered acceptable. Using this information, he can also adapt an instrument to the player's physical limitations. On Orlov's Steinway, for instance, he intentionally set the inertial weight in the bass to be on the low side to accommodate her weaker wrist, blending it into the normal range in the treble.

Ultimately, Stanwood says, he would like his procedures to be adopted by the major piano manufacturers, but they are understandably cautious about changing their time-honored methods even though, privately, some have acknowledged having touchweight problems in their pianos. Stanwood is sanguine about the slowness with which new ideas are accepted in this conservative industry, and is methodically courting performers and technicians to bring them to his point of view. "I am reassured of being on the right track when I see, time and time again, the spiritually uplifting effects of my work upon the pianist. It seems to strike at the core of what a piano is: a vehicle for emotional expression of which there is no equal."

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