Why Is It So Hard To *Mic A Piano?*

by Charles Helpinstill

Today's larger sanctuaries, and the growing trend to include contemporary music in worship services have caused amplification of pianos to become a problem for many churches. This situation parallels the problems encountered in the Concert Sound industry in the early '70's, when the first generation of piano superstars (Elton John, Billy Joel, Leon Russell, etc.) appeared on stage, all wanting to use acoustic grand pianos in the midst of highly amplified rock bands. The solutions to their dilemma are still available, but first let's take a look at the basic problem:

A PIANO IS A DISTRIBUTED SOUND SOURCE

Unlike vocals, horns or electric instruments like guitars played through amplifiers, the piano does not have a focused, single point for obvious mic placement. Pianos generate their considerable sound energy over a large area (the soundboard) that effectively couples the vibrations of thin strings to the surrounding air, without any one spot ever being that loud. Pianos also present an additional problem of having the low notes originate on one end, and the high notes on the other.

THE FIRST APPROACH: ACOUSTIC MICROPHONES

For solo piano performances, or a singer being accompanied by only the piano, a mic can get the piano into the sound system with limited gain before feedback, but if anything else is going on onstage, it's not much help. The human voice is capable of producing 110-db sound pressure levels directly in front of the mouth. There is no spot on a piano with SPL over 95, even when it's played hard. When the ambient SPL on stage during a Contemporary Worship group performance is in the 100-db range, a regular microphone close to the piano isn't amplifying the piano; it's a room mic! Using more than one mic to try to compensate for the high note-low note problem just compounds the effect, and additionally can introduce phase-cancellation effects that produce dead zones on the keyboard. Placing a mic on a boom stand inside the center of the piano with the lid open, or laying a vocal-type mic on a cloth inside the piano with the lid closed are common ways of approaching the problem, but are of little benefit in an ensemble format.

IMPROVEMENT NO. 1: PRESSURE ZONE MICROPHONES (PZM)

Closing the lid on a grand piano can help a little, by somewhat limiting the surrounding instruments' bleed-through into the piano mic. Unfortunately, regular mics then just hear the sound of the piano trapped in a closed space, and reflecting off the inside of the lid. A PZM attached to the underside of the lid can eliminate part of the problem, because its design cancels the effect of the reflecting surface, and eliminates some of the boxiness in the sound. Very little improvement will be noted in the gain-before-feedback problem, however, because it is still a microphone coupled to the air around the piano.

IMPROVEMENT NO. 2: VIBRATION TRANSDUCERS

Piezoelectric transducers attach to the soundboard, and offer an intermediate improvement to the gain-before-feedback ratio. They are also very simple to attach. Their main drawback comes from their sound source: the wood of the piano. This naturally results in a somewhat "wooden" sound, which may require a lot of equalization to be suitable. They also may lack some of the attack, or "punch," because the transients and high frequencies are stifled as the sound travels through the wood. The isolation from other instruments is moderately improved over mics, but the soundboard of the piano is just as effective at catching surrounding sounds as it is at amplifying the piano, and these outside sounds are sometimes picked up by the transducer. Transducers are also now available that attempt to monitor the vibrations in the plane of the sounding board (horizontal), as opposed to those striking it perpendicular. The theory behind this approach is similar to that used to produce directional (cardioid) mics.

IMPROVEMENT NO. 3: STRING SENSING

Although it's not obvious to the casual observer, the entire sound we recognize as the piano is contained in the string vibrations. Aside from the obvious note definition, the sound of the hammers striking starts the string moving, and that impact is registered in the strings. The characteristic wooden warmth of this acoustic instrument is also present in the strings, since they are connected to the sounding board through the bridge, and reflect this resonance. If it were possible to produce an electric signal that was an exact analog to this string vibration, and then translate this signal through amplifiers to speaker movements, we would hear the piano exactly as we do through the air, but without any chance of feedback or bleed-through. Fortunately, systems have been designed that do exactly that, and were first used in the early Seventies by the rock superstars mentioned earlier.

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Electrostatic piano pickups were the first detachable systems to monitor the string movements, but proved to be problematic in practice and were discontinued. However, string sensing pickups which operate on the same principle as an electric guitar pickup are available on the market and provide a worthy alternative. The benefits of using this type of system include a totally isolated piano channel for recording or amplification, total elimination of feedback, and a clarity of sound that results from taking the piano sound from its original source.

Installing a string-sensing pickup involves a little more care than placing a mic on a stand, since it is necessary for each string to be sensed for every note to be heard, but it is proving to be worth it in churches that strive for a state-of-the-art approach to their piano sound.

No matter what your solution is, hopefully this article has brought you closer to getting the beautiful, rich sound you want out of the instrument, to compliment and augment the worship experience in your church.

Charles Helpinstill has been granted five U. S. patents in the field of piano amplification, and since 1972 has been considered one of the world's leading authorities in the field.