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Why Pianos Don't Stay In Tune

New piano owners are sometimes surprised to hear that their piano needs to be tuned at least twice a year. Certainly a fair question is, "why do pianos go out of tune and what can I do to lessen this effect?"

Almost every instrument in the orchestra must be tuned on a regular basis and pianos are no exception. There are four main contributors to a piano going out of tune and, using Figure 1, I'll review each one in detail:

1. Material Characteristics: Changes primarily in the strings and soundboard
2. Environment: Humidity and temperature changes
3. Technician Effects: rendering strings and setting the pin
4. Pinblock Deterioration: Loss of pinblock grip

Figure 1 is a schematic representation of the main components in the "sound producing" portion of the piano. I've drawn this in orientation for a grand piano, but uprights are very similar. Starting from the right is the tuning pin which is anchored in place by the pinblock. The steel piano wire stretches from the tuning pin, through the forward termination (an agraffe, capo bar or v-bar depending on the piano), over the bridge (bass or treble) and is anchored in the rear by a hitch pin. Most important is the "speaking length" of the string that is struck by the hammer. It is this portion that vibrates, creating music, and must be tuned to a precise tension in order to get the proper pitch.

1 – Material Characteristics. A piano is made of a variety of wood, steel, felt, leather, plastic and adhesive, the characteristics all of which change over time. Most important for the topic of tuning stability are the soundboard and strings.

Soundboard material selection and aging are two factors all piano makers hold dear to their heart. Considerable effort goes into picking the right material (usually Sitka spruce) and aging / drying the soundboard. But even with all this effort, there is still moisture content left in the soundboard and ribs which go through a drying process over the life of the instrument. As the soundboard dries, it shrinks. From this shrinkage, the upward pressure through the bridge is reduced, reducing tension on the string and causing the pitch to go flat.

Although you may view piano wire as being exceedingly stiff and strong, it is in fact a ductile steel alloy that will stretch over time when under tension. As a string stretches, the tension is reduced and again the pitch goes flat.

These factors are strongest when a piano is in its infancy (along with general mechanical settling of the frame and parts). For these reasons, new pianos will tend to de-tune faster than more mature pianos and most piano makers recommend four tunings in the first year to compensate.

2 – Environment. From an environmental perspective, humidity has the biggest effect on tuning and again it's back to the soundboard. The soundboard absorbs some moisture and swells in size when the ambient humidity increases. This increases pressure up through the bridges, increasing tension and pushing the pitch sharp.

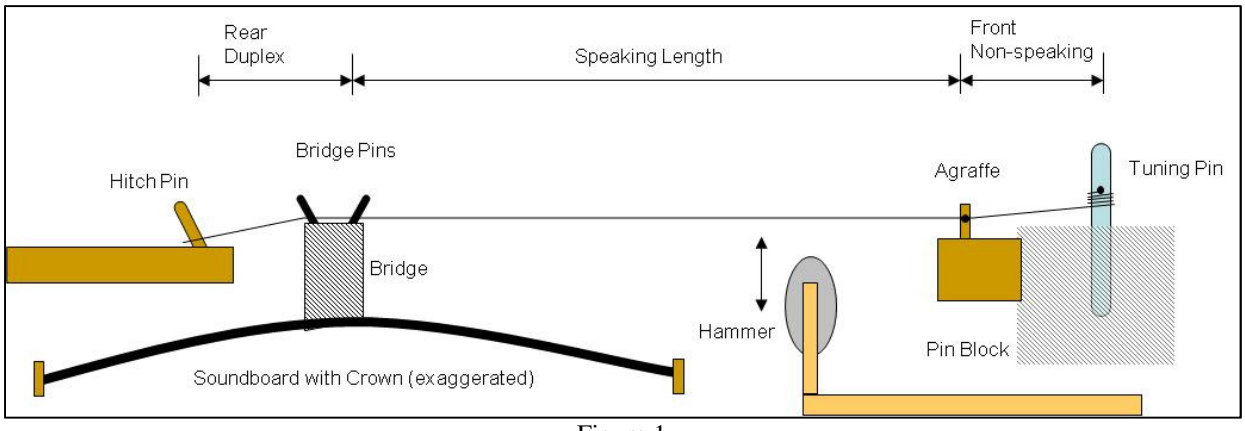

Figure 1

This effect is most pronounced in the mid-west and other areas that see big seasonal variations in humidity (very high in the summer, very low in the winter). This effect is less severe with our moderate climate in northern California, but you should still avoid putting your piano in areas with large swings in humidity. The ideal humidity for a piano is 40-50% rH. Inexpensive hygrometers are available to check this in your home.

Remembering back to high-school physics, objects expand when warmed and contract when cooled. Temperature changes can effect a piano in many (sometimes contradictory ways), but the most significant effect is on the strings. As they warm up, they expand ever so slightly, reducing their tension and sending the pitch down. (For this reason, technicians tuning a piano for a concert stage will sometimes tune slightly sharp of 440Hz. Once the stage lights come on and the house fills, the rise in temperature will drop the pitch.)

For these reasons, it is important to place your piano in a location that is environmentally stable: Free from drafts, away from heat sources and out of direct sunlight. Depending on your family's heating and air conditioning preferences, there may still be pitch variations when the seasons change.

3 – Technician Effects. It should come as no surprise that the skills of your piano technician will impact your piano's tuning stability. Whenever someone observes me tuning and says, "That's not so hard, I could do that", I usually point out that there's much more going on than meets the eye. Among others, two techniques that technicians use to deliver a stable tuning are called string rendering and setting-the-pin.

In the front of the piano, the agraffe (or capo bar or v-bar) terminates the speaking length of the piano as do the bridge pins in the rear. For a variety of reasons, it's important that the wires bend slightly at these points and as a result, friction occurs. But since there is friction at these bearing points, the tension in the different portions of the string may not be equal when a technician turns the pin. Later (while you're playing) this tension imbalance may encourage the string to slip ever so slightly past a bearing point, causing the pitch to change.

Skilled technicians work very hard during the tuning to equalize this tension through what is called "string rendering". The idea is that the technician wants the string to render across the bearing points such that all the lengths are at equal tension. This is accomplished by playing the notes very hard during tuning and through tuning hammer techniques. The degree of difficulty in rendering the strings is affected by both the piano's age and brand.

Also under the technicians control is a process called setting-the-pin. The tuning pins are anchored in place by the pinblock – a drilled, multilayered wood block that grips the pins. When tuning to a new pitch, the technician turns the top of the pin and (ideally) moves the pin to a new position in the block. Unfortunately tuning pins are surprisingly flexible (at least on the scale considered for tuning stability). So, it is possible to twist the pin, changing the tension and pitch of the string, without physically moving the lower portion of the pin in the pinblock. This is not a stable condition and over time, the pin may flex back to its original position (changing the pitch).

Skilled technicians work against this (and other effects) by setting-the-pin – ensuring that there is no residual twist or displacement in the pin before moving on to the next note.

4 – Pinblock Deterioration. Over time, the pinblocks in most pianos lose their ability to effectively grip the pins through deterioration of the wood. Fortunately, this takes many decades in high quality pianos and is usually a gradual effect. It starts with a piano that tends to go flat faster than normally expected and ends with a piano that is not tunable.

While there is little to stop this process, there are some treatment options. The most cost-effective is the application of CA adhesive to the base of each pin (by a qualified technician). The CA swells the wood fibers around the pin and restores the grip of the pinblock. It has been proven to be a very good, medium term (3-7 year) treatment for loose pins.

For higher quality pianos worthy of investment, the owner can consider either replacement of the pins with a larger size (usually done in conjunction with restringing) or complete pinblock replacement.

A final note regarding moving pianos. A piano that's been packed in a moving van and moved from one location to another will almost certainly need to be tuned on arrival. When moving from one climate to another (e.g. a very dry region to a very humid one), it's best to wait a few weeks before tuning. But just moving across the room should generally not throw a high quality piano significantly out of tune.

For more information or to request an appointment, visit www.mitchellpianoservice.com

