How Sound Can Change in a Trumpet

Drew Haney

The Trumpet

A trumpet is a brass wind instrument of relatively simple design. Sound is produced from blowing into the mouthpiece. Trumpets are famous for their small size and large sound. Despite the simple design, there is a lot that can change the sound of a trumpet. The sound is changed by the way the player blows into the trumpet, the valves or buttons, tuning slides, spit in the valves, and temperature.

How Sound Works

Sound is a wave. When a wave is produced, we hear a certain pitch, which is caused from the frequency, or length, of the wave. Frequency is the rate at which the wave vibrates. This pitch can be loud or soft. How a player blows into a trumpet is the main means to control the wave. There are two variables when you blow, the amount of air and the firmness of your lips.

When a lot of air is pushed through the trumpet, there is a lot of energy behind the sound. In terms of sound, the more energy put in, the louder the note becomes. However, making a note louder does not change its pitch. This change in pitch is accomplished by buzzing your lips.

Buzzing Through the Trumpet

If you were to simply blow through a trumpet, or even any instrument, no notes would come out. In order to produce the notes on a brass instrument, your lips have to vibrate. The technique is called buzzing. Buzzing is when you blow out of your closed mouth. The tighter you make your lips, the higher the pitch becomes, allowing the player to change the pitch. The change itself depends on the location in the scale. Lower notes are farther apart from each other, while higher notes are close together.

How Valves Work

There are three valves on trumpets. A valve’s main function is to control the length of tubing the air moves through before leaving the trumpet. Each valve has holes through it curving in different directions. The holes are used to guide the air through different paths. When the valve is completely open, or not pressed down, the air goes right through to the next valve. If the valve is closed, or pressed down, the air goes into a branching pipe before returning to the valve and finally getting to go to the next valve.

Figure 1: a trumpet and the major parts


Figure 2: Engineering Fundamentals Program - http://ef. engr. utk. edu/hyperphysics/hbase/Music/trumpet.html
The main thing to remember is that energy is lost while air travels through the piping. In music, these losses are measured in steps. A step is a specific difference in frequency of two notes. The distance is defined as consecutive notes in a scale. While all of the valves are open, or not being pressed, the step change is zero. The first valve lowers the pitch by a full step, the second Valve lowers the pitch by a half step, and the third valve lowers the pitch by three half steps. This effect is the same as a runner. A runner gets tired the longer they run. The air gets tired as well, becoming lower in pitch. The valves can be pressed together or on their own, resulting in eight different combinations for fingering. Fingerprint is the way a player may or may not press the valves.

**Tuning Slides**

Not every trumpet is made the same, and not every person plays the same. For this reason, trumpets also have tuning slides to adjust for inconsistencies. There are four tuning slides on a trumpet. There is one located at the first bend from the mouthpiece, and one located at each valve. These slides are the main method of changing the pitch of notes in a precise and controlled manner. Whenever a slide is pulled out, the sound becomes flatter, or lower. Pushing in causes the sound to become sharp, or higher. The pitch change is due to increasing or decreasing the length the air must travel to exit the instrument.

**How Spit Changes Sound**

Due to buzzing, spit comes into the instrument as well as air waves. Although the process is slow, the build-up can change sound noticeably. The player can tell when too much spit is in the instrument when the sound starts to waver. The liquid disrupts the waves as they travel through the trumpet, causing the sound to seem to vary when it should be steady. If the sound wavers too much, a popping sound can be heard while playing. This popping is surprisingly unpleasant, and is caused by the waves becoming too destructive, and canceling each other out at times.

**Playing at Different Temperatures**

The other way sound can be changed is from the temperature. Since the waves travel through air, if the air changes, so does the sound. The energy loss that has been discussed is due to the sound waves running into something in the air. The more the waves hit, the more energy is lost. This is the same effect as a bouncing ball. After every hit, more energy is lost and the ball can’t get as high. The frequency acts the same as the height of the ball. When air is heated, the molecules spread out more. The wider gaps allow the waves to travel farther and longer without losing energy. With less energy lost, the pitch appears to become sharper. In contrast, if the air becomes colder, the reverse happens and the sound becomes flat.

The room temperature is not the only thing that changes the temperature of the air in the trumpet. In cold environments, the trumpet also becomes cold. As mentioned before, the length of tubing matters for the pitch. Since a trumpet is brass, it elongates and shrinks with temperature. The player will be blowing warm air into a cold trumpet. As the warm air moves though the trumpet, the instrument warms back up. This phenomenon is a nuisance for marching band trumpeters, as the temperature is almost always different when they play.
Conclusion

When it comes to learning to play trumpet, all these factors can seem overwhelming. It is no wonder becoming just proficient takes years, and mastery takes decades. However, if a player takes their time, and learns the factors one by one, the task becomes less daunting. The trumpet can produce the most beautiful sounds, and music as well. However, playing the trumpet takes much discipline, and should be appreciated for the hard work necessary to earn the name trumpeter.