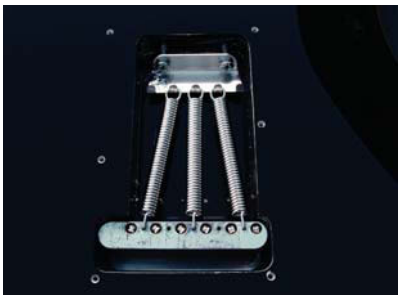
5-way pickup selector switch - Modeling

As determined previously in the Requirements Analysis portion, a pickup selector noise is composed of three main subsounds: (*1*) the switch noise, (*2*) the body resonance and (*3*) the tremolo spring vibration.

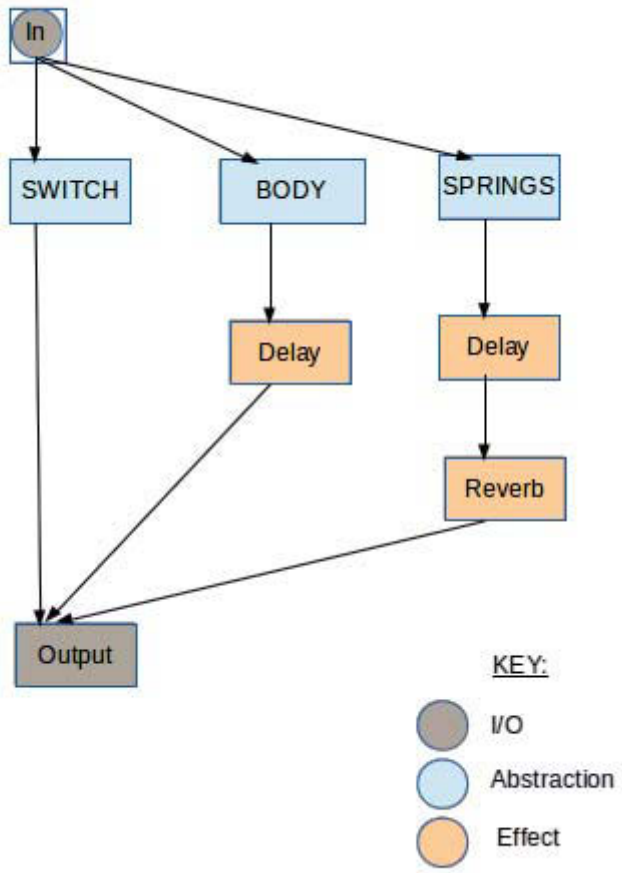
(1)

(2)



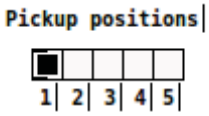
(3)

The proposed signal path layout for this model is shown below:

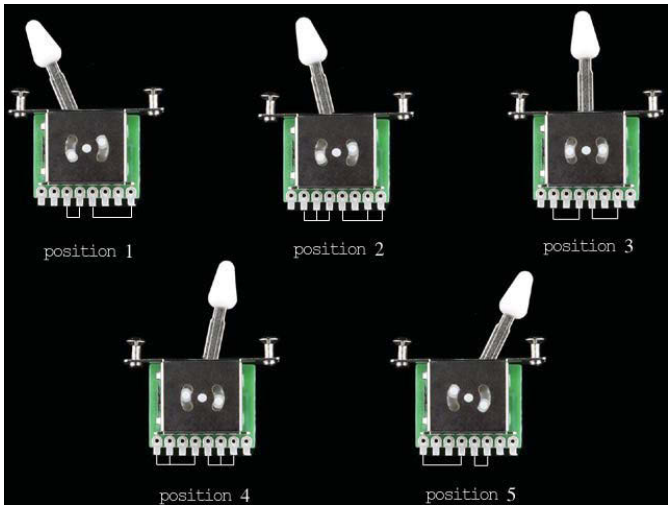


The only user input that is necessary to produce a sound should be a single impulse at the inlet (or a bang in pd), which loads a set of preset parameters for all three abstractions. (e.g., Switch, Body, and Spring, in the blue boxes above).

First, we review the switch noise. This occurs immediately upon receiving an impulse from the user, and is the only abstraction that is directly connected to the outlet. Since its the first part that the switch flipper's fingers physically comes into contact with which then transfers the initial burst of energy to the rest of the system, it follows that it must occur before either the body or spring noises. For both these depend on the vibrations propagated by the force on the switch to occur.



This abstraction will have a user-adjustable parameter (above) which will match the number of possible pickup positions the guitar has. Typical settings are 2 (for Les-Paul style guitars) *OR* 5 (for Stratocaster style guitars). However, the user will then be able to select any setting from 2 *through* 5, allowing even less-common configurations to be emulated.



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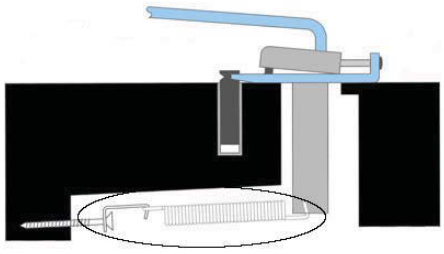
Examples of guitars with 3 position switches include early 50s Stratocasters, which initially only allowed the user to select between each of the three single-coil pickups individually. The technique of combining pickups did not become popularized until the late 50s, when players found that they could jam broken matchsticks into the pickguard slot to hold the switch in "between" positions. This clever modification opened up a whole new world of possible tones (and soon noise-cancellation!) for players.

The number of clicks that occur is the *[number of possible pickup positions]-1*. So Les-paul switches will only have one click, whereas strat-style switches will have four.

Next up is the body noise. This has to have a short delay before being audible, as the energy from flipping the switch takes some finite time to propagate throughout the wooden body. The sound, which is a dull “thud” noise, travels throughout the empty body cavities routed to hold the pickups and electronics.

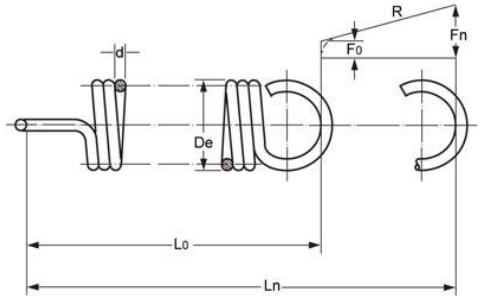
The actual delay time will have to be measured from several high-quality recordings which are then averaged, and pre-set for the abstraction. The user should NOT be able to change this setting, as it will stay relatively constant for similar types of body shape/ wood type.



Finally, the spring noise. The tremolo springs, which are circled above, are located in the back of any guitar equipped with a whammy bar. They are “extension springs” which are springs whose coils touch that are used for pulling. These differ from “compression springs,” which are used for pushing, and whose coils do not touch. Below is an image showing the intended extension spring action:

There are normally 3 to 5 springs connected to the bridge block at any given time, depending on the player's preferences. Less springs will offer lighter tremolo-arm actuation, while more springs will improve the instrument's tuning stability, especially on bends.

The number of springs used, and the tension at which they are tightened will dramatically affect both the pitch and the intensity of the ringing. This parameter will have to be measured through visualization. The user should NOT be able to adjust this setting, as it stays relatively constant once the guitar is set-up properly.



This noise also has a short delay, as the energy takes time to propagate from the body through the bridge and tremolo block. As with the last abstraction, the actual delay amount will have to be measured through a set of audio samples and then averaged for best results.

The springs will also need some reverb, as they ring out for 2-3 seconds with rapidly decaying intensity. The reverb parameters must be preset according to trial-and-error in order to realistically reproduce the sound. When all three signals are combined and sent to the outlet, this will form the basis for the pickup selector sound.

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