Class Demo: The Violin

I felt that the section explaining the motion of a string being bowed (M.T., pg.120) was rather unclear, particularly in the discussion of its relationship to moving and static friction. As for the diagram on the following page, it only increased my confusion. Now that I understand this process better, my objective is to clear up the role of friction between string and bow by providing a better visual to understand it.

I think that most people (who don't play a string instrument or study physics) have something of an intuitive understanding of the fact that the bow is moving the string, without necessarily understanding the mechanics of how it does so. After reading about the properties of horse hair and rosin, I think most people can get as far as understanding how that would aid in the tendency of the bow and string to stick to one another (static friction), and consequently how the string would be dragged along as the bow moves up. After this point is where things seem to get a little foggy. The idea of this demo is to show how once the tension of the string overcomes the static friction and the string breaks away, it slides down against the bow (moving friction) until a combination of the friction slowing it down and the tension of the string (this time coming from the other direction) causes it to stop, and consequently stick, again.

<u>Materials</u>

-two lengths of velcro: about an inch wide and 2-3 ft. each (1 loops, 1 hooks)

-four bookends

-packing or duct tape

-one piece of wood (or other sturdy substance):2-3 inches wide, and also about 2-3 ft. long.

-one thick sheet of hard plastic: variable width, also 2-3 ft. long

-spool of sewing thread (preferably same color as velcro)

The idea behind using velcro to make the bow and string is that the loops and hooks would hopefully interact similarly to the former: that is, not just imitating the snapping motion, but actually remaining in contact while one slides down the other.

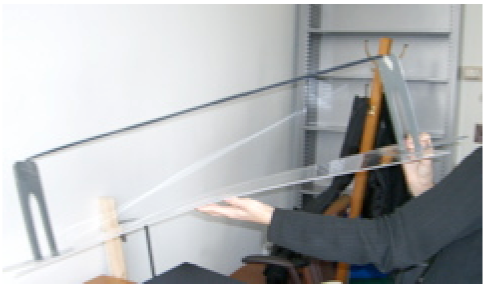
* Just to clear up: hooks is the hard, scratchy plasticky kind and loops is the soft, hair-like kind.

<u>The "String"</u> (use hooks)

-In order to turn this flat piece of velcro into a string, we are going to turn it in upon itself (width-wise of course) as tightly as possible and wrap the thread around it, tying the first "wraparound" into a knot with the end of the thread in order to secure it. Wrapping the thread around in even and small spaces will of course ensure a firmer hold and more uniform product. *It may be easier to complete this process with two people.

-Fasten the ends of the string to the tops of two bookends using the tape.

-Then fasten the bookends to the sheet of plastic also using the tape. The reason for using plastic is so that the students can view the motion of the "string" from the other side, where their view will be unobstructed by arm or bow.



<u>The “Bow”</u> (use loops)

-Fasten the ends of the velcro to the other two bookends with the tape.

-Fasten bookends to the length of wood with the tape as well.

In a lecture on the violin, the instructor might lead into the demo by discussing the differences between static and moving friction (the students should already have read about the frictional properties of the bow) and how the two interact with one another. Examples such as the one about pushing a box across the floor (M.T., pg.120) are useful in illustrating this point because they put forth the notion of lesser friction as a function of lesser resistance, which is easier to coneptualize. The instructor would then introduce the demo as a way to understand how friction works in the bow’s moving of the string, which is step one in getting the violin to produce a sound. S/he should explain what is happening between bow and string on a real violin just before bowing the velcro, and then explain how each part of what the students observed corresponds to the real thing. S/he could lead out of this demo and into the waves produced by this action by showing a computer animation of slow-motion exaggerated waves on a string being produced as a bow moves over it, and from there into the rest of the story…

The value of this demo, and consequently of understanding this concept, is multi-layered I believe. First off, it is useful to have a three-dimentional example (as opposed to a computer program/applet) because the concept *is* three dimensional. For people who have trouble conceptualizing, it often helps to have a physically present illustration instead of some abstract lines moving on a video screen. The added bonus is that they can try it for themselves after class! Within the realm of the violin, an understanding of the motion better explains why a bowed string might produce a triangular wave, and why closer to the bridge the wave looks different (vertical snap-backs due to tension overcoming friction faster). Understanding that even as it snaps back, the string slides down the bow instead of detaching from it gives an idea as to why it sounds so different from a string being plucked. On a broader level, I think that being able to thoroughly understand this idea gives us a way to solidly conceptualize and have a reliable tool/reference point for future encounters with the interactions of static and moving friction, and their effects upon the substances they interact with.