

# PHYSICAL MODELS AND REAL-TIME CONTROL WITH THE SENSEL MORPH

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## ABSTRACT

In this demonstration we present novel physical models controlled by the Sensel Morph interface.

## 1. INTRODUCTION

The Sensel Morph is a highly accurate touch controller that senses position and force of objects [1]. Figure 1 shows one player interacting with two Sensel Morph devices to interact with the developed physical models. We use the Sensel as an expressive interface for interacting with different physical models described in a companion paper accepted to SMC 2019. Right above the touch-sensitive area, the Sensel contains an array of 24 LEDs that can be controlled from the application.

Strings are shown as coloured paths (see Figure 2 for a descriptive visualisation). The state of the string is visualised using the vertical displacement of the paths. Bowed strings are shown in cyan on the top left. The bow is shown as a yellow rectangle and moves while interacting. The fretting position is shown as a yellow circle. Plucked strings are shown in purple in the top right, underneath which the sympathetic strings are shown in light green. The plate is shown in the bottom using a grid of rectangles (clamped grid points are not shown). Its state is visualised using a grey-scale. Furthermore, connections are shown using orange circles/squares for the points of connection and dotted lines between these points. Lastly, all parameters that are controlled by the mouse such as output-level and plate-stiffness are located in a column on the right side of the application.

## 2. IMPLEMENTED INSTRUMENTS

We subdivide string-elements into three types: bowed, plucked and sympathetic strings. All strings will be connected to one plate acting as an instrument body of which the user can control the plate-stiffness. Furthermore, the user can change the output-level of each element type. Apart from these parameters, which are controlled by the mouse, the

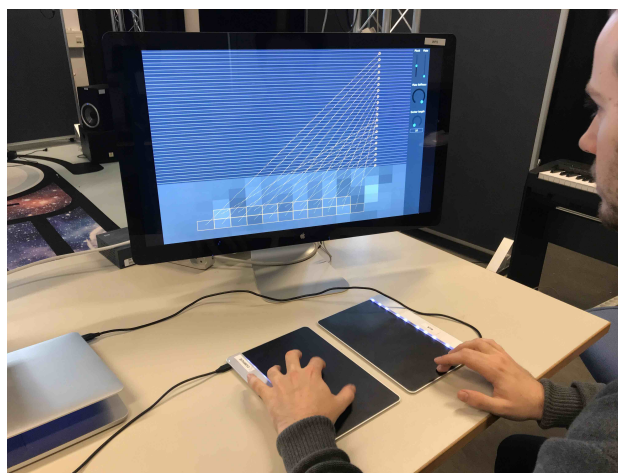


Figure 1. Player using the Sensel Morphs to interact with one of the instruments.

instruments are fully controlled by two Sensels. The instruments we have chosen as our inspiration are the sitar, the hammered dulcimer and the hurdy gurdy.

### 2.1 Bowed Sitar

The sitar is originally an Indian string instrument that has both fretted strings and sympathetic strings. Instead of plucking the fretted strings, we extended the model to bow them. Our implementation consists of 2 bowed strings (tuned to A3 and E4), 13 sympathetic strings (tuned according to [2]) and 5 plucked strings (tuned A3-E4 following an A-major scale) as it is also possible to strum the sympathetic strings. Figure 2 shows the visual interface of the implementation. One Sensel is vertically subdivided into two sections; one for each bowed string. The first finger registered by the Sensel is mapped to a bow and the second is mapped to a fretting finger controlling pitch. The horizontal position of both fingers is visualised using the Sensel's LED array. The frets are not implemented as such (the pitch is continuous), but they are visualised for reference.

### 2.2 Hammered Dulcimer

The hammered dulcimer is an instrument that can be seen as an 'open piano' where the musician has the hammers in their hand. Just like the piano, the strings are grouped in

