



# Design for sound

## Innovative designs

### Acoustic interactivity

An often-overlooked aspect of a 3D printed part is the sound it makes. We can deliberately design parts to achieve particular sounds.



*Figure 1: For example, thin mobile pieces that contact each other when shaken can create a soft, silvery sound*



*Figure 2: Large hollow parts with reasonably thin walls and holes can create a nice resonance. In the example above, the cut-out "tongues" on the drum act like cantilevers. The tone they generate is a function of the mass of the cantilever and is therefore controlled by thickness, length, shape, and cross section*



*Figure 3: You can also 3D print percussive membranes, like the tambourine pictured above. Printing the tambourine with the membrane side down at a 30-degree angle helps avoid warpage of the membrane*

## Case study: pneumatic instruments

### Designing in sections

By combining a bellow structure with other components, it is possible to make 3D printed pneumatic devices and musical instruments. The bellow parts demonstrated here are robust and flexible enough to survive sandblasting, and generate air pressure when compressed.

The prototypes consist of more than one part so that excess powder can be removed from the air chambers. They are then assembled into functional objects. The air channels in the parts are also designed to be a reasonable size to ensure that all excess powder can be released through them.

- This air pump is composed of two parts: a bellow and air valve. It blows air out when the bellow is pressed.

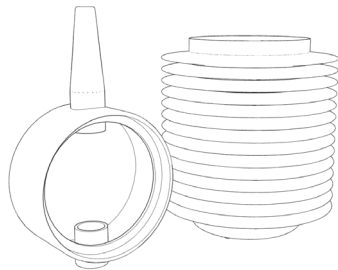


Figure 4: Air pump design

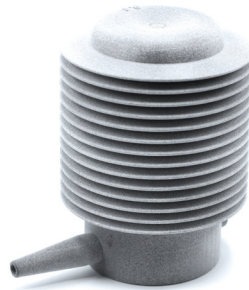


Figure 5: 3D printed air pump



Figure 6: Bellow being pressed

- This musical instrument makes a funny sound when played. A 3D printed whistle also can be attached to make a more tuned sound.

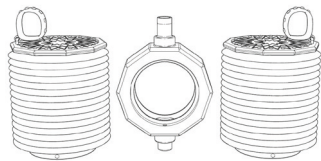


Figure 7: Musical instrument design

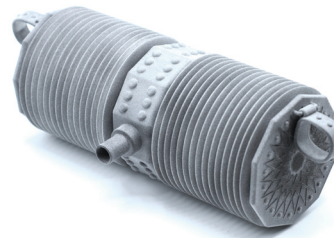


Figure 8: 3D printed musical instrument

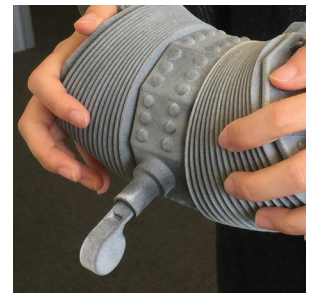


Figure 9: 3D printed musical instrument being played

- This pneumatic device can be controlled with an electronic pump. When the bellow is inflated by the pump, it expands and pushes the flexible mesh panel upward. To prevent air leakage, a pressure washer and O-ring are attached to the screw joint parts of the bellow and cap.

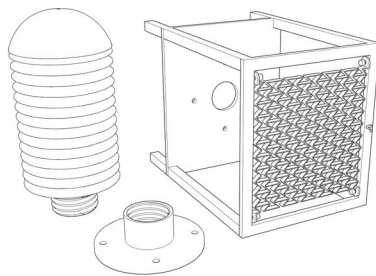


Figure 10: Pneumatic device design

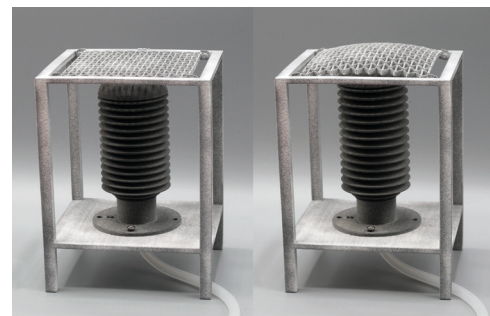


Figure 11: 3D printed pneumatic device

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