How to make a gaming soap for $35 or less

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ABSTRACT

Soap is a one-handed pointing device that works in mid-air. Before reading this, make sure to familiarize yourself with soap and its interaction paradigm by visiting http://patrickbaudisch.com/projects/soap. This page also links to the soap demo video which features a 3-min how-to video. The purpose of this paper draft is to help readers to make their own soap prototypes. It expands on the content featured in the video and provides a shopping list and more detailed assembly instructions.

The device described in this draft is a *gaming soap*, a special version that works well for first-person shooters and that is particularly easy to make. While it offers the whole gamut of interactions in horizontal directions, its vertical axis is limited to "joystick interactions". We also briefly demonstrate how to convert a gaming soap into a regular soap, which then supports all types of horizontal and vertical interactions and can be used as a general purpose pointing device.

Like any device, soap can be optimized by using custom hardware, such as a custom board designs. The design described in this paper, however, is designed to require only off-the-shelf components that can be found in computer and drug stores.

If you have questions email me; my email address can be found at http://patrickbaudisch.com/biography. Also, let me know how it went and how you modified or improved the original design described in this paper.

SHOPPING LIST

Most of the following components can be bought at an electronic store and a drug store. As of the date of writing this paper (July 2006), the material costs were about $35, $30 of which is accounted for by the wireless optical mouse.

For the core

1. **A wireless optical notebook mouse.** The smaller the better. It is generally easy to find very slim mice, yet finding one that is short as well is hard. After comparing several models we opted for a *CompUSA sku 309750*, which was the smallest of the models we had looked at. This mouse also offered a very clean board design which made it easier to further reduce the size of the board by stripping away the mouse button and wheel section of the circuit board. This mouse offers a long focal range, which is good for making a soap. More expensive mice often limit the focal length to avoid drift while lifting and repositioning the mouse. This can be problematic when making a soap, because soap's curved casing requires the optcs to have a certain focal range to allow the sensor to see the hull. The compUSA mouse works well, at the expense of having a poor wireless range—3 feet maybe.

2. **Two AAA batteries** may already come with the mouse. Watch batteries do not offer sufficient current, but two half AAA might do as well (we have not tried).
3. **10"/25cm 1-wire cables**. We will need these for moving the left mouse button and for connecting batteries.
4. **a 1cm x 1cm x 5mm (+/-) block of plastic or wood** to prop up the left mouse button micro switch.
5. **a 3"x2" piece of elastic fill material** to make sure the mouse optics don't more around and to minimize the required focal range by pushing it against the hull. We used a 1/4 " sheet of foam material.
6. **A rubber band** to hold the battery pack on the circuit board. We used one which was wider then thick that helps creating the sideways tension that pushes the batteries into the connectors.

For the shell

7. **Two clear oval 2-ounce/59ml plastic bottles** (1¾" wide, 1" thick, excluding the neck 2¾" high) for the casing. While it is possible to buy such bottles online (http://www.sks-bottle.com/340c/fin116.html), they tend to come in lots of 40+ units. We therefore got two bottles of *RiteAid Instant Hand sanitizer* from *RiteAid*, and emptied them out. They are made of PET #1 material, which is very clear, but does not glide as well as #2 plastic. Opaque bottles work as well, but you will need to cut a hole to allow the optical sensor to look outwards. A plastic casing is good for our click mechanism described below.

8. **5”/12cm of clear adhesive tape** to hold the casing together.
9. **5”/12cm of two-side adhesive tape** to hold the ring inside the hull and the micro switch in place.

For the outer hull

10. **a baby sock** as the outer hull. If you can’t find a matching sock, get a different product made of this type of fabric. The stretchier the better—fake fur works great. The use of a sock also minimized the number of seams, as it has no seams on the side. The hull is also a great opportunity to give your soap its personal look and feel.

11. **needle and thread** to sew the outer hull
12. **1-2 Snap fasteners** or a safety pin to close the hole in the outer hull

For the inner and middle hull

Moving a sock over PET plastic takes a comparably large amount of physical effort, which also impacts the targeting accuracy. One way of addressing the problem is by adding a “liquid bearing” between core and hull, a layer of oil or other lubricant contained between two hulls made from a waterproof material. Hull materials are work in progress. Check out http://patrickbaudisch.com/projects/soap/hull for the latest insights. One possible design uses the following materials

13. **a teaspoon of oil** as a lubricant. We have used oil from the cosmetic department at RiteAid, but clear Mineral oil might potentially work better. I would assume that oils found in a kitchen might get sticky after a while, so I’d stay away from them. Soap or water-based lubricants worked less well with some plastics.
14. **two thin and robust plastic bags** to contain the lubricant. We are still working on finding the best material for this. We obtained reasonable results from loosely fitted zip lock bags. Earlier solutions involved latex (degrades quickly and tend to get stuck and break) and similar products made from polyurethane (which addresses these problems and generally works well). The latter are particularly easy to seal with a simple knot. The former requires a properly temperature-adjusted iron and more skill.

Solutions involving liquid bearings require extra care. In particular they need to be resealed whenever replacing the batteries unless one uses inductive charging. Also, if the hulls break lubricant can spill. But it is the best working solution we have so far. If you have a solution that works without liquids let me know.

Tools

In terms of tools, we used a solder iron, a band saw for cutting the casing and the circuit board, a belt sander, pliers, scissors, a wire stripper, and cleansing alcohol. But tools found in a regular household should work almost as well.

FOR GAMING

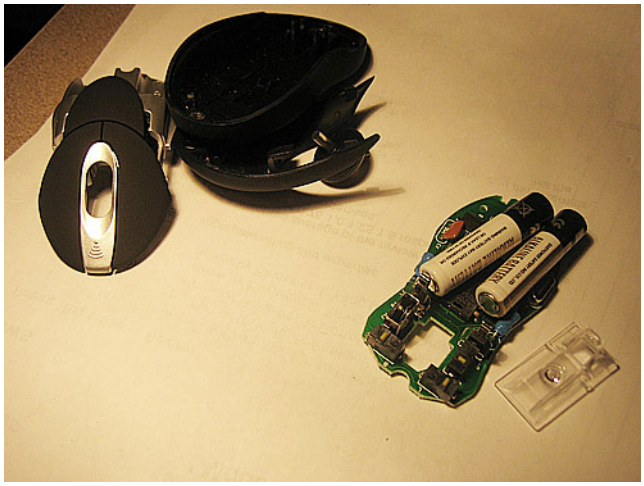
For mouse + keyboard gaming, I also use a Targus AKP01US Wireless Stow-N-Go Keypad from CompUSA.

It does not allow pressing more than one button at a time, so it is really not that great for gaming. Let me know if you find a better one.

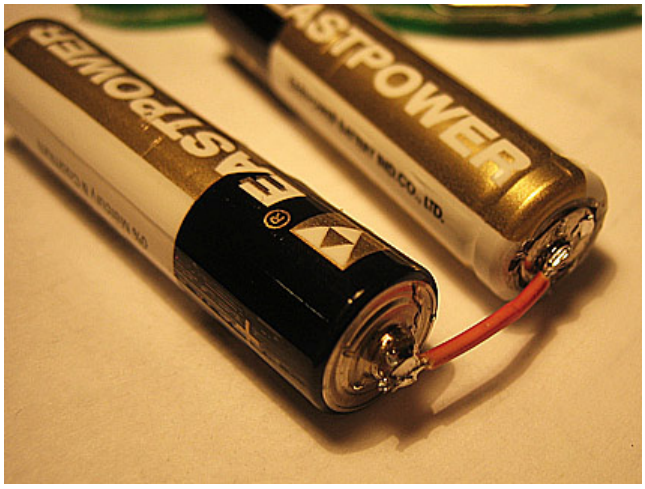
ASSEMBLING THE DEVICE

Open the notebook mouse and remove the casing. Remove the mouse wheel as well. Keep the part with the clear plastic piece with the prism though.

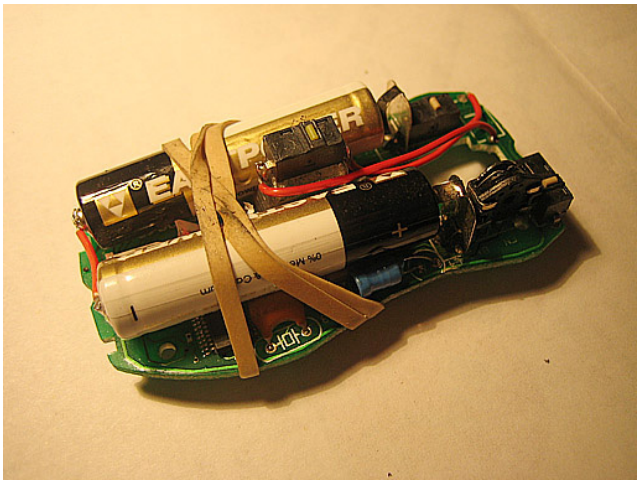
1. Circuit board: Removing the mouse casing removes the backside of the battery casing as well.

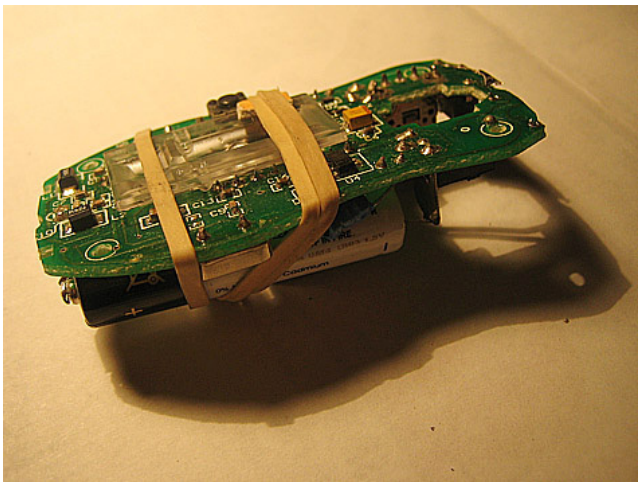


Use a cable to connect the + side of one battery with the – side of the other.

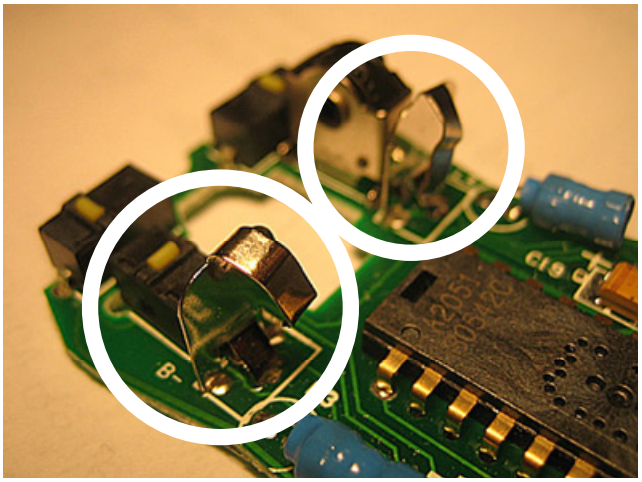


Using the rubber band mount the batteries on the back. Use the same rubber band to hold the clear plastic element with the prism in place. Sheer the rubber band to create tension that pushes the batteries into the connectors.





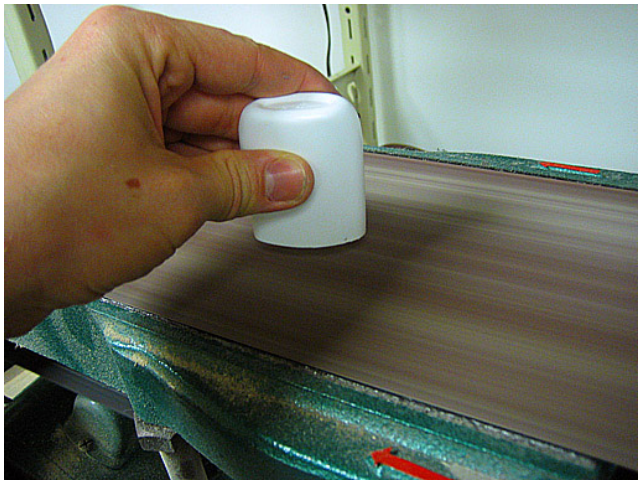
Without the mouse casing the batteries will sit lower. Use the pliers to adjust the battery connectors to fit the new height.



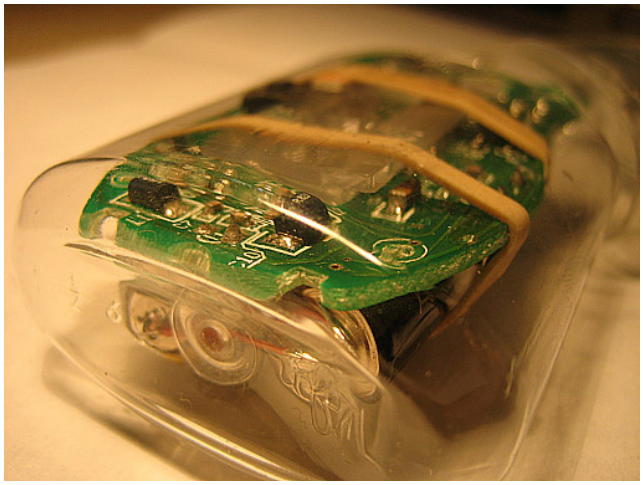
2. Casing: Empty out the two plastic bottles. Remove the labels. Remove glue residue using alcohol.

For the gaming soap we used the bottoms of the two casings. Cut them to roughly the right length; use different lengths to make sure the seam won't be over the sensor.

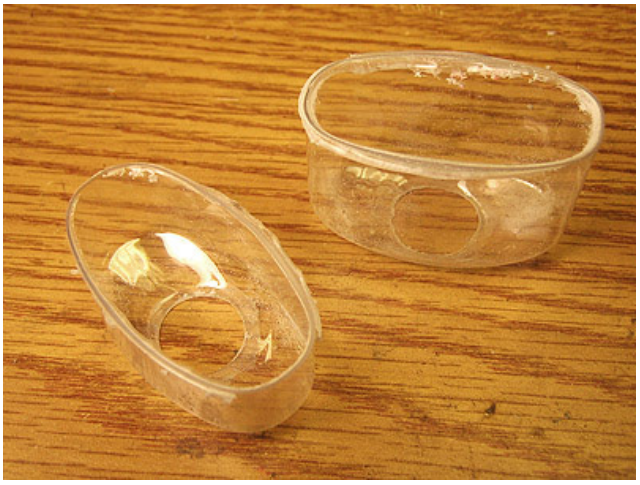
Then use the belt sander to fine adjust the lengths and remove seams.



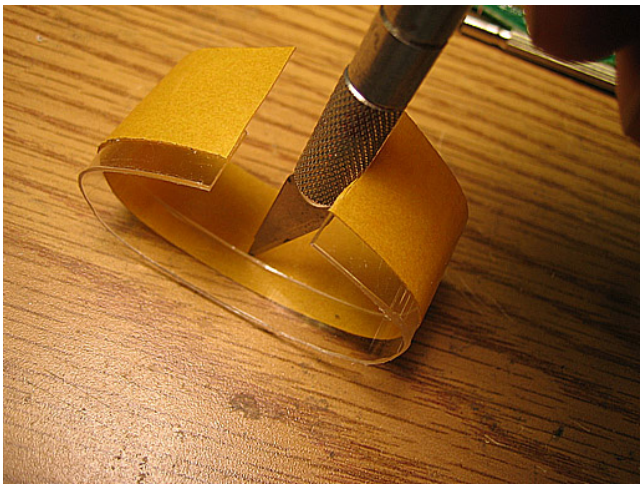
The bottoms of the bottles are bent inwards—if everything goes well they will hold the circuit board in place.



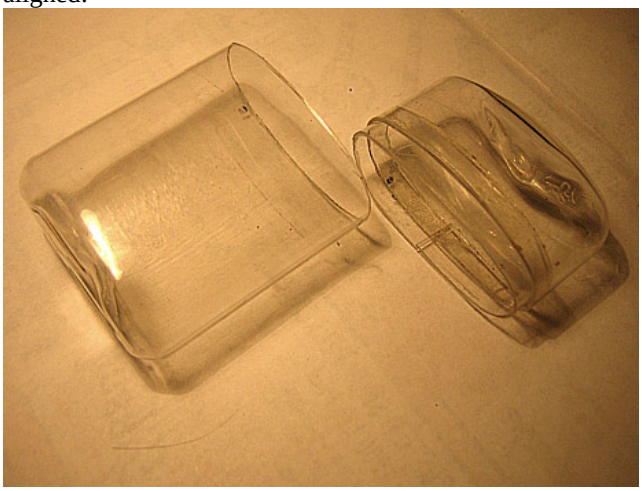
If making a 2D soap use the top parts of the bottles instead; they don't have the bent-in parts which will help save a couple of millimeters which is important for this design.



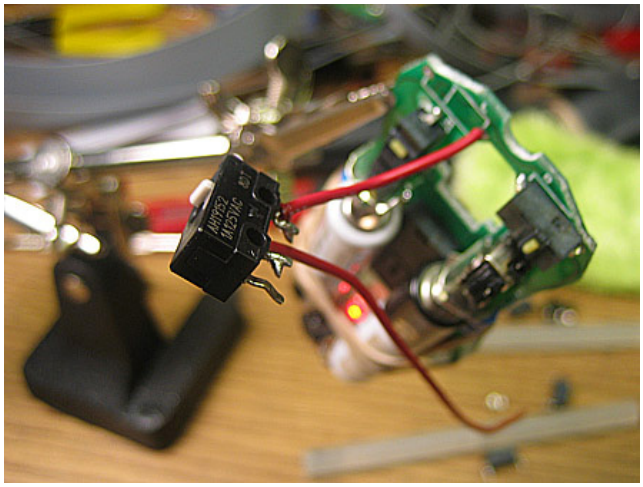
Of the remaining bottle material cut a ¼–½" ring. Cut out a 4mm piece.



Glue the remaining open ring half-way into the shorter part of the casing using double sided adhesive tape. This will strengthen the casing and make sure the two halves stay aligned.

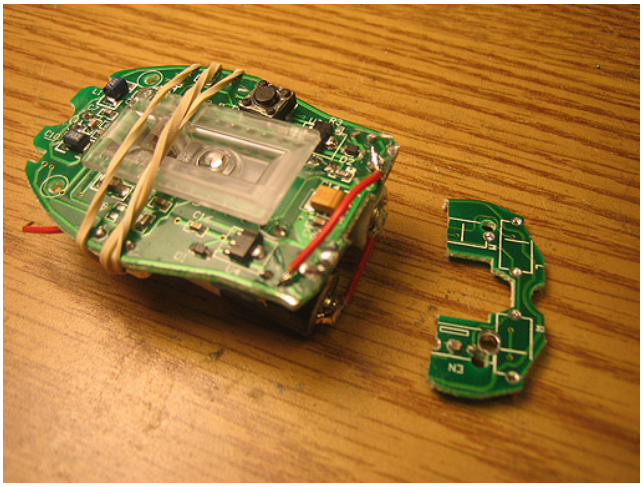


3. Mouse button: Use the solder iron to remove the micro switch that serves as the left mouse button from the board.

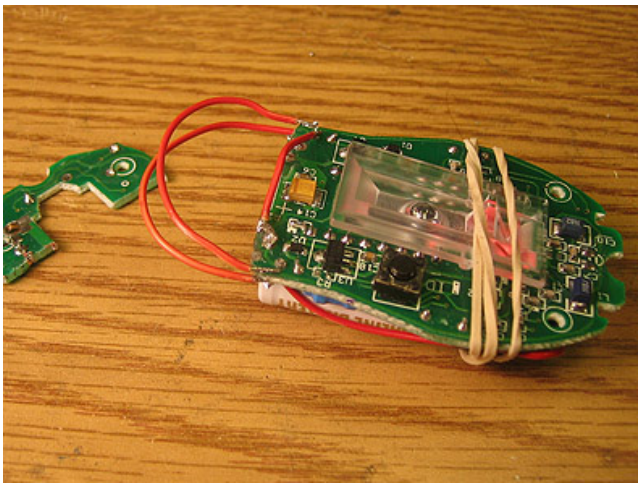


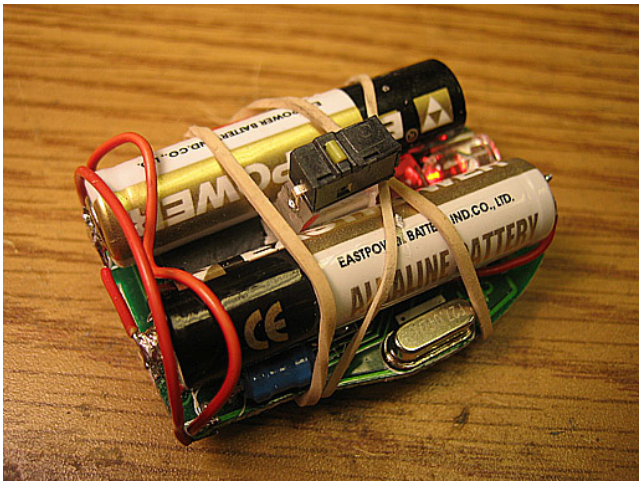
You will now move it to the center of the device. Adjust the height of the block of plastic/wood, you will use it to prop up the micro switch such that it reaches the inside wall of the casing. Mount the block on the back of the chip between the batteries using the two-sided tape; then mount the micro switch on top of it. If you are making a gaming soap, connect the micro switch with its original location on the board using two cables of matching length.

For the more complicated short design: If you have opted for the 2D clutching design (which you probably have not, because it is somewhat tricky), clip off the part of the circuit board with the mouse buttons.



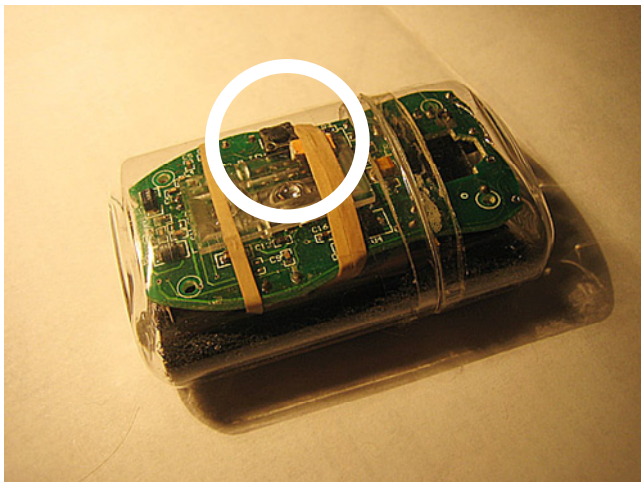
Scrape of some isolation and solder the mouse button connection straight onto the board. Do the same with the conductive paths serving as the antenna (top and bottom of the board).





4. Assembly: Cut a hole into the filling material to make space for the micro switch. Then put the filling material on top of the device and slide it into the casing. Double check that pressing the casing triggers the micro switch.

The bottom of the board has the sync button that is used to sync the device with the base station. Make sure this button can be pressed with a strong press at the right location, but will not be triggered when pressing the mouse button.



Use the clear adhesive tape to seal the casing.

If you opted for the non-lubricated version, skip this step and go straight to “6. outer hull”.

Lubricated version: Place the core into the first water-proof hull. Remove air and seal (e.g. with a knot depending on the material you are using). For the shorter 2D version the knot can get in the way and can make your soap not only harder to operate but also bears the risk of tearing the next layer of the hull. One possible trick is to cut a hole into the core, e.g., at one of the ends, before applying the hull. Now you can hide the knot in that hole, e.g., by removing the air before sealing the hull, which causes the knot to get sucked into the hole.

Stick the core with its first hull into the second hull and fill the lubricant between the two layers. To avoid bubbles, use plenty of lubricant at first to push out the air, then push out surplus lubricant before sealing the second hull. The amount of lubrication is an optimization problem. More lubricant means that your soap will be easier to operate, but also moves the hull further away from the optical sensor and might lead to tracking errors.

For the gaming soap, it does not matter too much were you tie your knot. For the shorter 2D version, it does matter. The hull should sit equally tight (or loose) along all axes. Irregular hull tension will make your soap run irregularly, because the soap core will always try to align itself with the specific symmetry of the hull. For a loose hull this is easy. For a tight hull, try to make the hull roughly as long as it is wide by tying the knot such that the remaining length roughly matches the width.

6. Outer hull Cut the hull and sew it close except from a hole just big enough to slip in the device. When designing your sewing pattern avoid placing seams at immediately opposed sides. Sewing two halves together in a ravioli-shaped way. For example, will make your soap run irregularly, because the soap core will always try to align itself with the specific symmetry of the hull. Check out tennis ball and juggling ball sewing patterns.

Sew on the snap fasteners. Pull the outer hull over the device and close the buttons.

DONE

Let me know how it went. I am sure you found several ways how to do things different or better, so please email me about your ideas (again, you can find my email address at http://patrickbaudisch.com/biography).

REFERENCES

1. Baudisch, P., Sinclair, M, and Wilson, A. Soap: a pointing device that works in mid-air. To appear in *Proceedings of UIST 2006* (Technote), Oct 15-18, 2006.
2. Soaphomepage http://patrickbaudisch.com/projects/soap