

Satin liner for cloth face masks (with cup effect to increase surface area for air-filtering)

- Using cloth masks does not reduce the supply of surgical masks for medical professionals
- Cloth masks are **not at all as good as** surgical, N95, or FFP1/2/3 masks for filtering anything out of the air the wearer would breathe in.
- Satin has “low porosity” which may be good for filtering.
- This mask (with a satin liner) has been worn for trips out of the home since 2nd March
- Liner takes 15 mins to make for a pre-existing cloth mask
- Satin, velcro dots, scissors, chalk, copper-wire, sewing machine (or needle and thread) needed.

This was the mask purchased online. It's stretchy and of a polyester/cotton mix.



This guide adds a satin liner for extra air filtering

Here I mark the location of the velcro dots, and the metal nose clip that I threaded into the hem, that I had unpicked in order to do that, then re-sewn:



Red = top

Blue = bottom

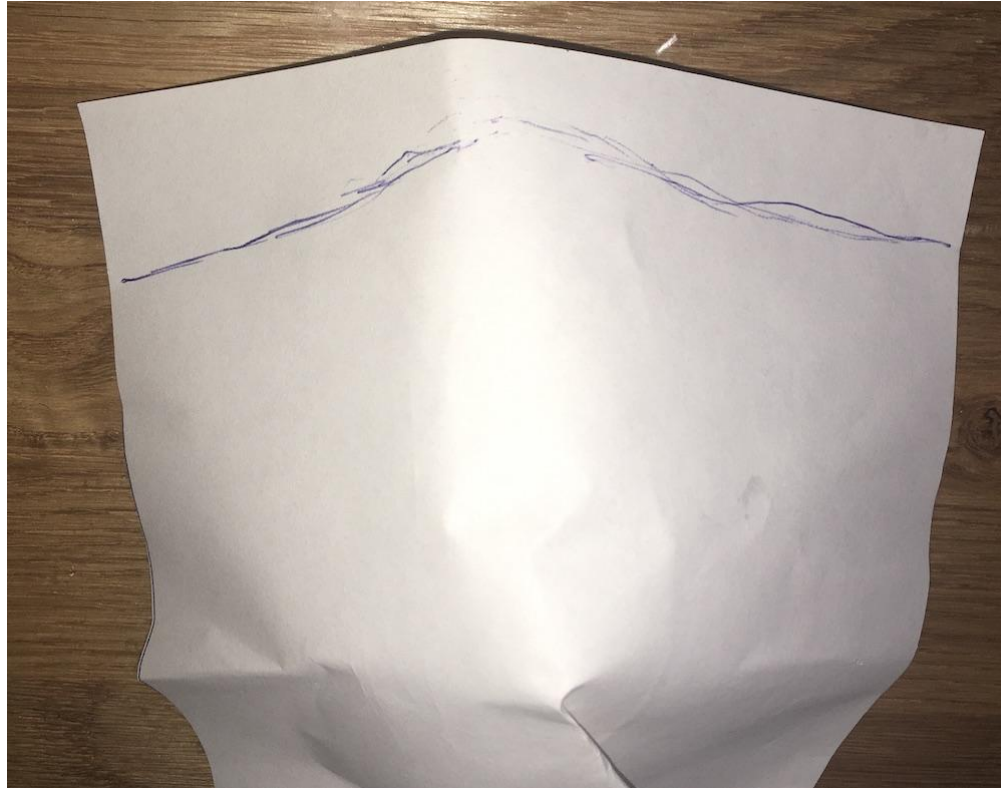
The nose clip wire should be plastic coated for eye-safety and pliable to some degree while holding its shape. You can use a few “twisties” if you have them.

The outer mask placed correctly on the wearer's face with a square of paper underneath, and a pencil line drawn on that to show the top edge only of the outer mask:



This paper piece is going to be a template for the satin liner 4

The paper taken off the face still in 3D, with the top of the template for the satin liner marked in pen:

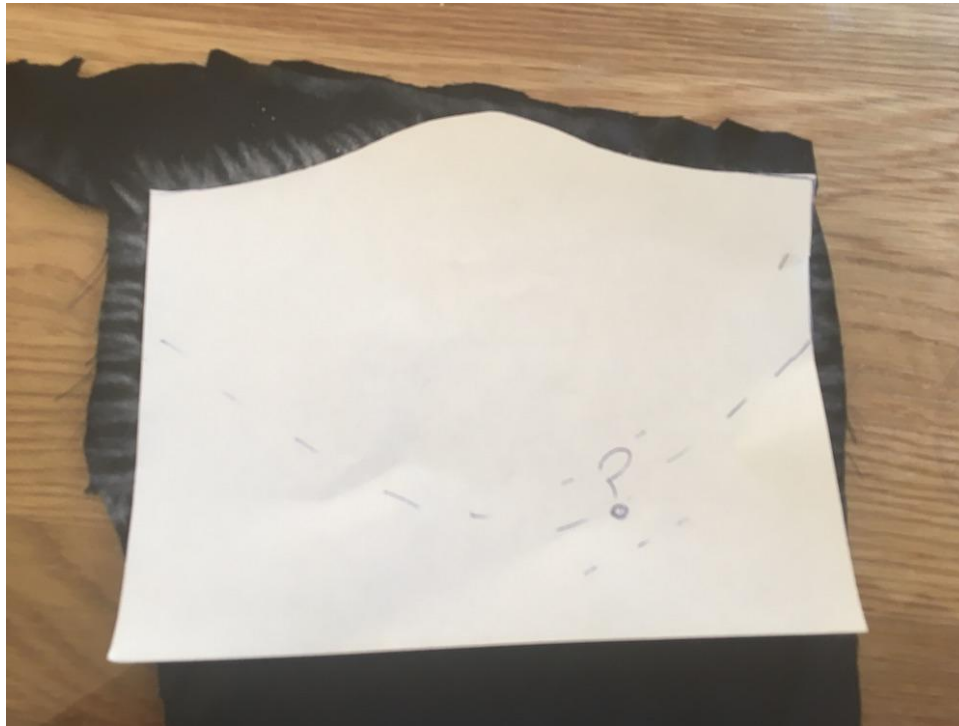


Note the scrunched up bottom piece that was necessary to make the outer mask fit well before marking the paper, but we are not marking or cutting the bottom of this template for the would-be liner yet.

Flattened out, now cut the top line as best you can.
Even it out if needed (should be a left to right mirror):



Here I've placed the paper template on a larger piece of satin. We are only going to mark then cut the left, top and right edges. Thus, it is deliberately long (top to bottom) as that cut will come much later in this process:



White tailor's chalk was used to mark top, left & right edges 7

With the paper removed, white chalk marks more visible. Our intention is to make a liner with a single layer of satin:



Now cut to that chalk mark line:



Line marked about where the copper wire will go:



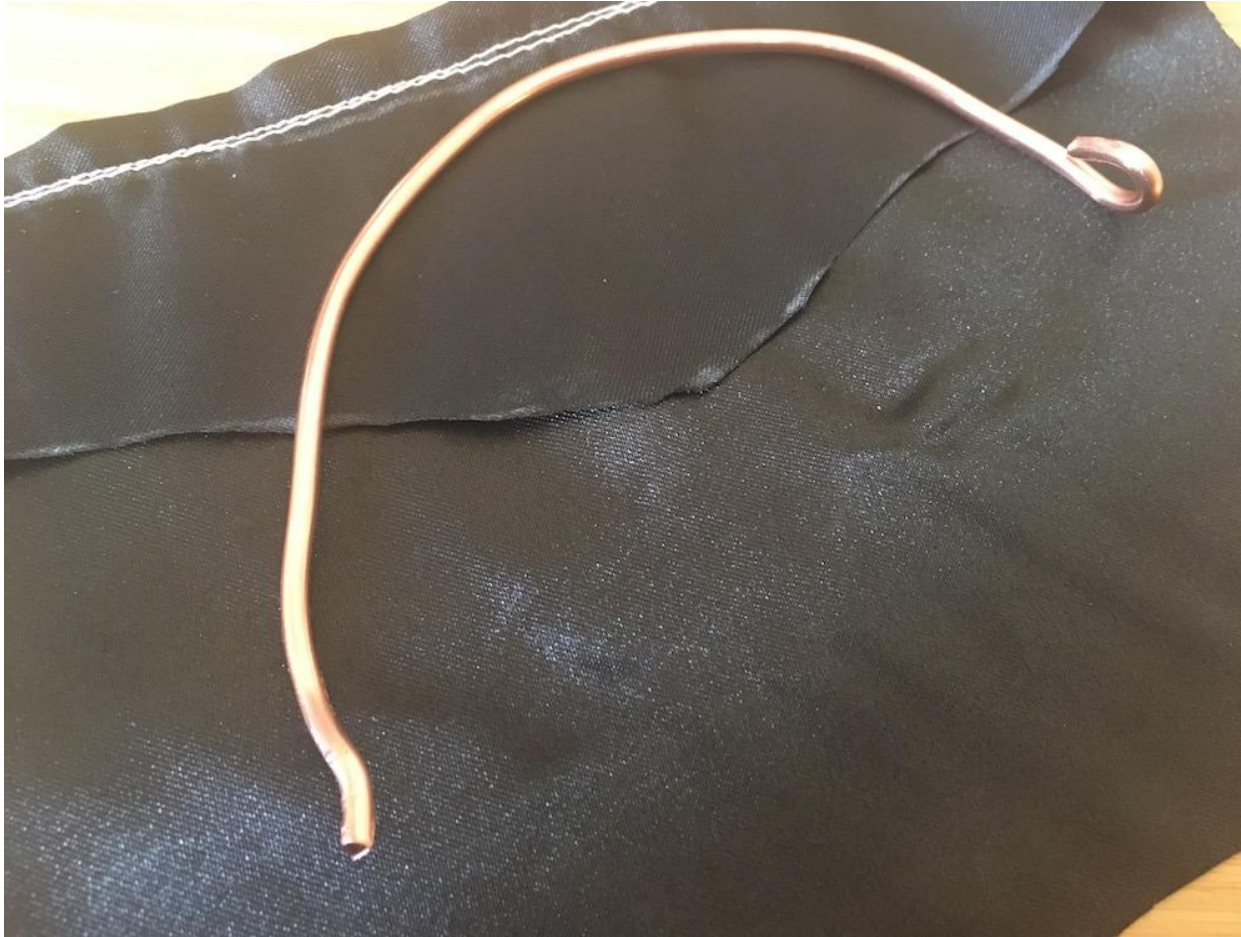
That line now a pocket after running that through the sewing machine:



Thread ends need to be tied off:



The wire I am about to thread through. It is roughly bent already, but the right length for the width of the mask.



Wire threaded through, and sharp ends bent over with pliers to protect the wearer's skin when in use:



Put the six velcro dots on the **top** edge only:



Remember that the mask stretches a little when it's on your face, but the liner does not.

Put the liner in the outer mask - again, using the six velcro dots on the top edge only:



(tailors chalk in pic too)

Wearing the mask part complete and facing a mirror, ensure that the liner is pulled down neatly into position. You can see that the liner is clearly too long:



In this pic, the reason for the mirror is clearer - I have chalked the satin liner at the point where it sticks out under the outer mask:



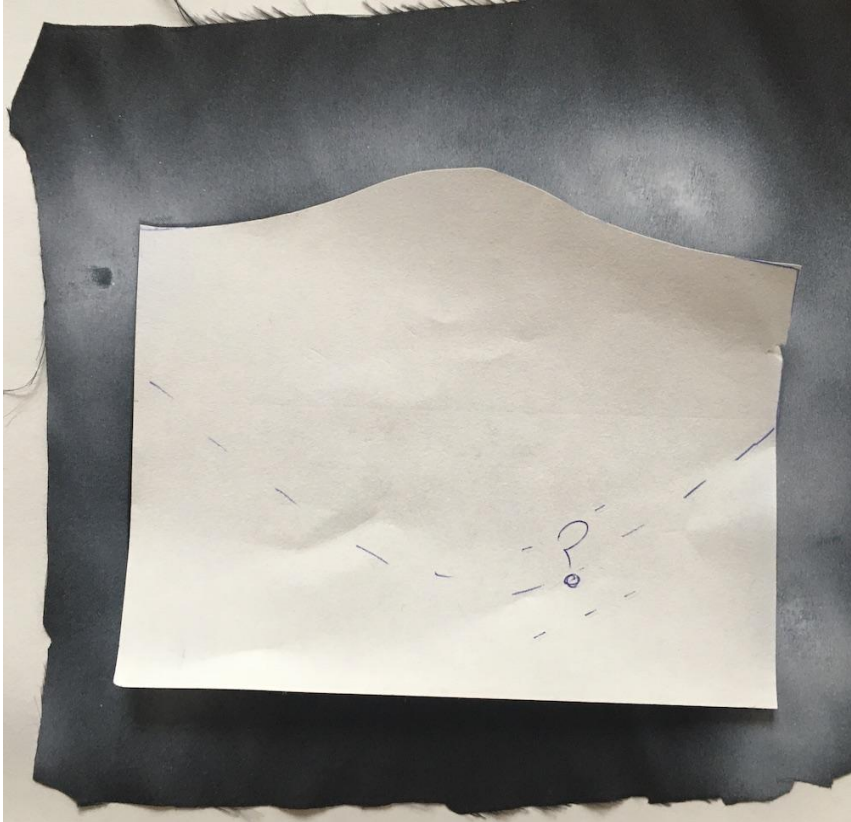
Here's that chalk line when seen from above and the mask is flattened out on the table:



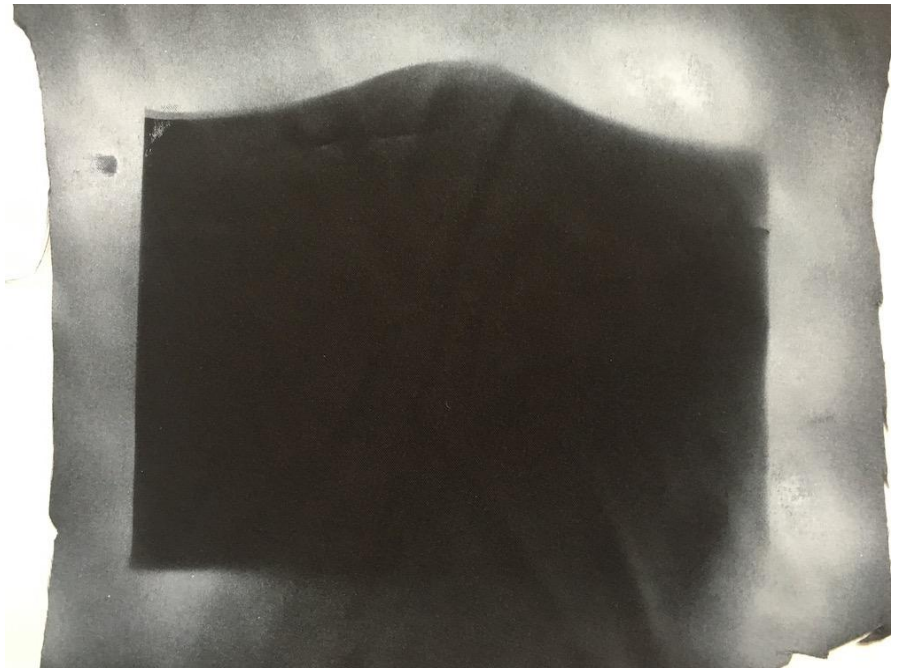
Then cut that excess off and discard it:



Instead of chalk you could try spray paint, but it is messy. Make sure to hold down the paper as you spray the edges:



Paper template,
sprayed



Paper template
removed
ahead of scissor work

Here's the liner in the outer mask, remaining **bottom** velcro dots in position (I am holding the left side of the mask off the table for this pic. You can just see the copper wire sticking out on the left hand side:



The wire in its pocket is the far side of the liner but it could easily be the near side (pros and cons)

The edges of the satin liner can be sealed to prevent fraying in a candle flame. Just in case: do this outside so you don't accidentally burn your home down:



Notes

1. The same mask with satin and **no copper wire guard** is actually harder to breathe through. The cupping action of the wire does increase the surface area to draw breath through, by holding the fabric away from your nostrils/lips as designed. The copper wire is flexible so that it can be bent in-situ for the best cupping action in front of the wearer's face. At least cupping without pushing the sides of the mask away the wearers face which would let unfiltered air in and out.
 - a. A version of this mask with the satin liner but without a copper wire guard was worn on a London trip where I was likely exposed to COVID-19 (March 2-4) and had to self-isolate at home for a week (I was notified a week after the end of the conference).
2. I have now made **two** identical liners (each with their own 3mm copper wire), so one can be hand-washed and dried as I am wearing the other.
3. I don't actually know the air permeability or porosity figures for satin and whether it is good enough for virions that are 125 nanometer in diameter that are inside water droplets from exhaled breath (etc). I wish that <https://smartairfilters.com/en/blog/best-materials-make-diy-face-mask-virus/> also listed satin for comparison to other fabrics. The design in this guide could be used for other fabric liner choices, too.

Future Modifications & Experiments

1. Hand sewing the velcro dots after sticking them is probably needed, as washing the liners can weaken the glue, and dots fall off. Replacing the velcro dots' own glue with "flexible super glue" didn't work. Machine sewing the dots in place was a horrible "bunching" mess. At least it was with my \$20 Amazon sewing machine.
2. A pre-formed **plastic** rod or cage of some sort *may* be better than this copper wire for the same cupping features.
 - a. Plastic that's under tension to hold the bow shape will not be a good choice as it will pull the edge of the mask away from the wearer's face.
 - b. Another good possibility is some old electrical wire (in its plastic sleeve). Success criteria is the wire holding its shape after bending. I've not tried this at all.
3. A two-layer satin liner might be worth trying ... if that is not impossible to breathe through.
4. This design could be used for liner fabrics choices other than satin. I'll update this section as reports come in.