The Jolene Cookbook

Version 3.0

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Instruction Guide

Version 3.1

Oregon Health & Science University

Oregon Hearing Research Center

University of Northern Colorado

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Welcome to the Jolene Cookbook©

Research suggests that a significant number of young people are acquiring noise-induced hearing loss. A recent study indicated that 16.8% of American adolescents between 12 to 19 years of age had hearing loss from noise in one or both ears (Henderson et al, 2011). Although we cannot know exactly what sounds are causing all of this noise exposure, the Dangerous Decibels® Research Project at Oregon Health & Science University (OHSU) and the Oregon Museum of Science and Industry (OMSI) determined that 87% of 13 to 20 year-olds in their study group had used stereo headphones during the last year. As of September 2012, over 350 million iPods worldwide. This increase in popularity of portable music devices may increase the risk of noise-induced hearing loss (NIHL), especially in the younger generation, who seem to be "plugged in" at all times. NIHL and tinnitus (ringing in the ears) are unfortunately serious health conditions, and very few successful efforts have been made in the way of intervention; however, interventions do work.

Educational interventions can increase knowledge about NIHL issues. One study found that fourth and seventh grade students who received the Dangerous Decibels classroom program showed significant improvement, ranging from 10-52% increase in correct responses. (Griest. 2008) Two critical characteristics of effective health communication programs are customizing the program to the target audience, and using interactive, rather than passive, instruction. Both of these tactics were incorporated in the design for this sound level measuring system.

Jolene is a free-standing, visually intriguing, human-like sound measuring device. Users who put their headphones in/on her ears will be given a sound pressure level reading in decibels, letting them know approximately how loud they are listening to their music device. Jolene's sound level meter will inform the participant if the level is either safe to listen to, or potentially damaging to their hearing. Jolene represents a new strategy of hearing health promotion and research.

The following are instructions on how to construct your own personal music system sound measurement device. Included are a list of essential tools and materials, where to acquire them, and approximate costs, as well as step-by-step directions on how to assemble the device. Whether you are a middle school student doing a science project, a teacher looking for a classroom activity, or a healthcare professional, or scientist, building your very own Jolene is a fun, hands-on way to explore hearing health and safety. Be creative. Make it your own. Take her on tour.

About the authors:

Genna Martin graduated from Boston University in 2009, where she studied photojournalism. As a student at Lincoln High School in Portland, OR, she was a research educator for a National Institute for Deafness and Other Disorders funded component of the Dangerous Decibels® project. She and other high school students presented the Dangerous Decibels® classroom program to 4th graders and studied the impact on knowledge, attitudes and behaviors regarding exposure to loud sounds. She created Jolene as a research and education tool during a summer fellowship in 2006 in the OHSU CROET - Center for Research in Occupational and Environmental Toxicology. She has now made several sibling versions of Jolene and continues her work in photojournalism and hearing health promotion.

Billy Martin is Professor of Otolaryngology at the National University of Singapore where he directs the Center for Hearing, Speech and Balance and the M.Sc. graduate training programme in Audiology. He is also the co-director the Dangerous Decibels international noise induced hearing loss and tinnitus prevention program with materials now in 37 countries. Billy has a wide range of clinical and research interests spanning the fields of physics, hearing, neuroscience and population health.

Presently, his research projects examine community based hearing loss and tinnitus prevention in Native American/Alaska Native children, the neurobiology of deafness, hearing health promotion in Southeast Asia/Pacific Islands and the medical economics of hearing loss.

About the authors:

Deanna Meinke is Professor of Audiology and Speech-Language Sciences at the University of Northern Colorado and Co-Director of the Dangerous Decibels Program. She has served as past president of the National Hearing Conservation Association. Presently, she serves as a special consultant to the National Institute for Occupational Safety and Health (NIOSH) and chairs the "Safe-in-Sound Expert Committee". Her research interests are focused upon the early detection and prevention of noise-induced hearing loss.

Don Finan is Associate Professor of Audiology and Speech-Language Sciences at the University of Northern Colorado. His research interests are on signal processing for speech and hearing, interactions between the auditory system and speech production.

Getting Started: The Jolene Cookbook is for everyone! You can make your Jolene by yourself (although some steps require two people) or with a group. If you are working with a group it is helpful to divide into teams. One team can work on the mannequin construction, while the other is working on the sound level meter. If you are younger than 13, you should ask for help from an adult. The project should take about a weekend to complete and, depending on how much you choose to spend on clothing and accessories, it will cost approximately $100 - $150.

Where to begin? Start by getting all of the parts and tools together. Take this list shopping with you. You can purchase the clothes and accessories later. The following supplies will support the production of two ears with one sound level meter in either of the two ears.

Parts Checklist:

☐ Mannequin torso with head: $50.00-$75.00. Inexpensive mannequins may be found on Ebay (www.ebay.com) or Craigslist (www.craigslist.org). A 1-piece mannequin constructed of hollow plastic is best. You will need to reach inside the head to attach a bracket. Fiberglass mannequins can be more difficult to work with. A two-piece mannequin with separate torso and head can also work, however you may need to cut large (3.5"+) holes at the neck/torso junction to allow for passage of wires and to place a bracket inside the head. Suitable used mannequins may sometimes be found at department stores or flea markets, and small damaged areas may be fixed with a glue gun or epoxy.

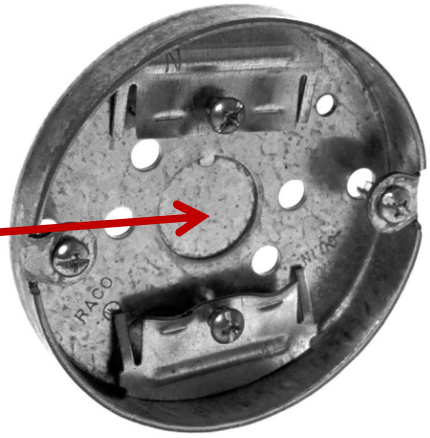
☐ Sound Level Meter: The sound level meter shown here is sold for approximately $25-30 under "CEM", "Tenma", "Pyle" and other brand names. You can find this sound level meter at www.PartsExpress.com (#390-722), www.Amazon.com, or other online retailers.

☐ Right or Left Silicone Ear: acquired from Westone Inc (Demonstration Ears Product ID# 20221, www.westone.com). These have the look and feel of human ears. $18.00

☐ Clothes/Accessories: Acquire from various places including Goodwill, garage sales etc. $20.00

☐ Paint: One can of plastic spray paint (ensure that the can states "no primer required"). We recommend that you also buy a can of clear gloss spray paint to apply after the color. This will protect the color layer from getting scratched or chipped. $6.00 per can

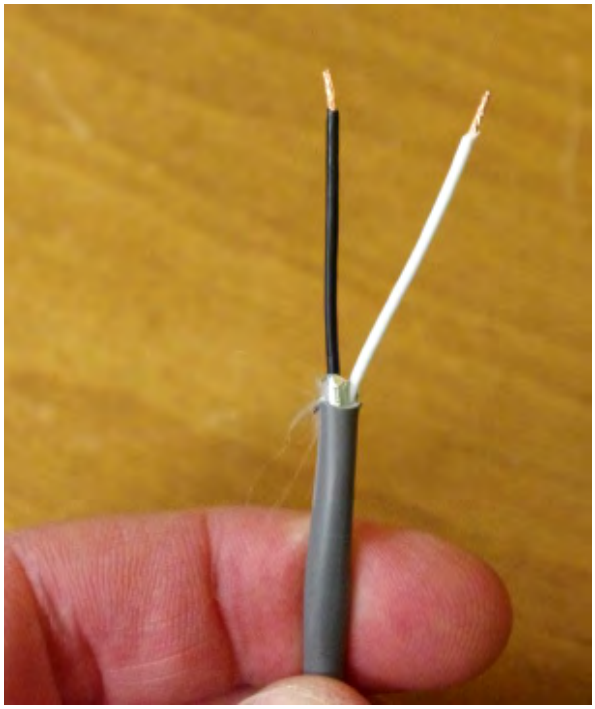
☐ 3.5" or 4"" diameter shallow (1/2" deep) round electrical box (Raco #8292 is a 3.5" box), approximately $4 at Home Depot or other hardware stores. This will be used to hold the silicone ear in the mannequin's head. You will need to remove the two cable brackets (top and bottom of this picture) and knock out the center hole cover (indicated here) with a hammer.



☐ Screws: 2 screws (8-32 1" long machine screws) may be necessary depending on the thickness of the plastic of your mannequin. The above electrical box will come with two screws, but a thick mannequin head may require longer screws.

☐ 1/4” mono phone (TS) plug and jack. You can get a right angle plug (shown here on left) or a straight plug. The right angle plugs will be easier to hide under your mannequin’s clothing, however. These type of connectors are available at Amazon.com, Radio Shack, and many musical instrument stores. Switchcraft type L11 long-bushing jacks (shown on right) are recommended, as they will fit through the thick plastic mannequin body easily. Approximately $2-4 for each part.

☐ Instrument or microphone cable with two conductors (22 AWG gage cable works well). Cable with an outside diameter of approximately 1/8” will fit nicely into the sound level meter housing (www.PartsExpress.com #100-246 works well). You’ll need two segments, each about 3’ long.



☐ Small electrical wire (“zip”) ties, 6” or smaller in length, 1/8” in width.

Tools Checklist:

1 3/8" plunge blade for oscillating saw above

☐ Saw that can cut a square hole: Multipurpose oscillating-blade saw (www.HarborFreight.com model 68861 is shown here, but similar oscillating tools will work just as well) with an approximately 1" plunge cutting blade (also shown here).

A jigsaw (or sabre saw) with a standard cutting blade can also work well..

jigsaw

☐ Power drill and 3/8" and ¼" drill bits..

☐ Soldering iron with a fine point tip and electrical solder.

☐ Left to right: adjustable wrench, needle nose pliers, small phiillips screwdriver, wire stripper.

☐ Hollow (hole) punch, 3/16” or ¼” to create a hole in the silicone ear for the sound level meter microphone. A drill bit may also be used to make the hole, but this is more difficult and will not make a clean hole..

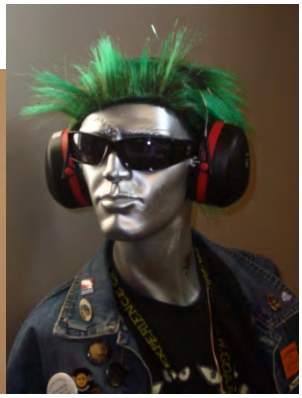
☐ Electrical tape. High quality (such as 3M Super 33+) tape is recommended.

☐ Duct tape

☐ Hot glue gun & glue sticks

☐ Optional: heat gun (hot air gun, not a hair drier) and heat shrink tubing.

- ☐ Safety goggles and ear protection for drilling and cutting.



- ☐ Flat metal file and/or sandpaper.
- ☐ Round metal file

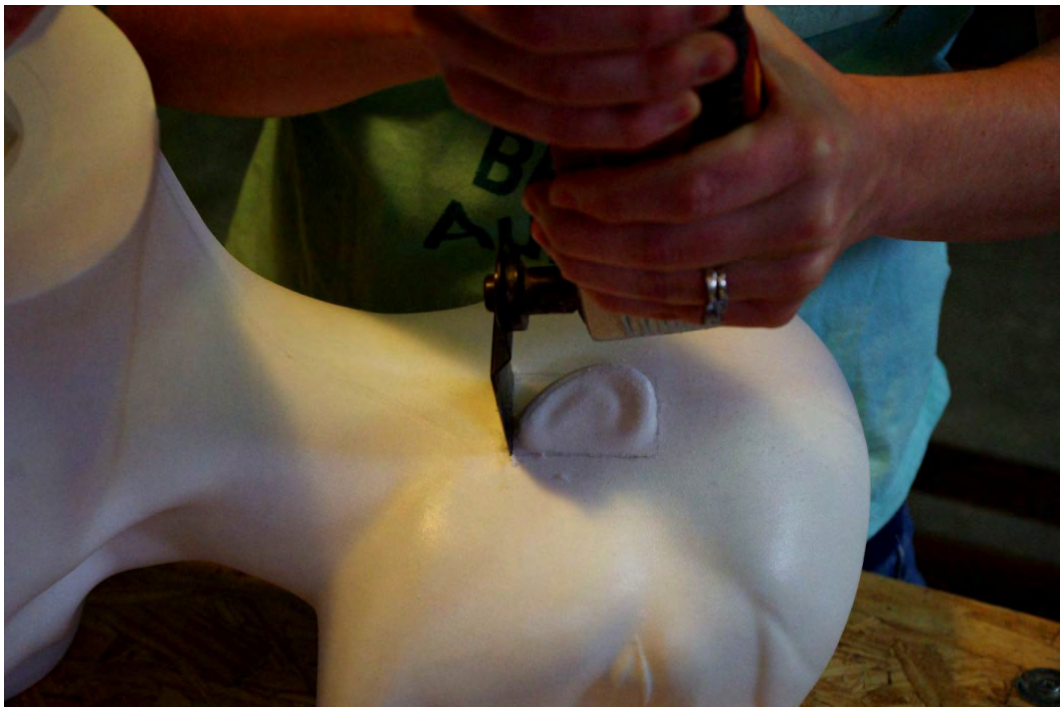
- ☐ Medium sized phillips and standard (flat) screwdrivers.
- ☐ Hammer
- ☐ Center punch or medium-sized nail
- ☐ Tape Measure
- ☐ A “build” partner
- ☐ Cold beverages and pizza to entice your partner to help
- ☐ Optional: non-permanent thread locking compound (e.g. Loctite Blue 242)
- ☐ Optional: vise mounted to a workbench and/or electronic “helping hands” vise.

Step 1: Cutting the ear holes:
Materials: Mannequin, silicone ear, oscillating saw (or jigsaw), file or sandpaper, pencil, safety eye goggles and ear protection.

If using a jigsaw to cut the hole, you'll need the drill and ¼" and 3/8" drill bits in order to start your cut.

Hold the silicone ear over the mannequin's ear (make sure to use the correct side of the mannequin based on your specific silicone ear) and draw an outline of the hole on the side of the head where the ear will go. You may choose to cut the mannequin's ear off flush to the head before marking the hole, but this is not necessary.

Cut ear holes in the mannequin head to fit the silicone ears. A partner is useful for this step to help stabilize the mannequin as you cut. If you use the oscillating saw, press the plunge blade straight down on your guide lines. You will be able to cut straight lines and sharp corners. Cut just to the inside of your guide lines, as you'd like the silicone ear to fit tightly (and you can always increase the size of the hole if needed with a file).



If you are using a jigsaw to make your ear cutout, first drill four ¼" starter holes, one at the inside of each corner of your guide lines. Use the 3/8" drill bit to increase the size of those starter holes so that the jigsaw blade will fit easily.

You can now insert the jigsaw blade into each of these holes in turn in order to cut along the guide lines that you've drawn as you want the silicone ear to fit snugly in the opening, with no chance of falling out.

Again, make sure to cut just inside the guide lines as you can always enlarge the opening with a file if necessary (below).

Note: You really only need one silicone ear in the head to do sound measurements. You can install two if you like, but you can save time by just installing one.

After cutting, you may be left with burrs around your cutout.

Use a file or sandpaper to remove the burrs and to smooth the edges of your cuts.

Now's the time to test fit your ear and make adjustments to the cutout if necessary.

Step 2: Installing the ear bracket.
Materials: 3.5” round electrical box (1/2” deep), screwdrivers, hammer, drill & ¼” drill bit, spring center punch or nail.

First, remove the cable clamps from the 3.5” round electrical box.

Next, punch out the center tab using the hammer and flat screwdriver. Make sure to file any sharp edges that remain in the center tab hole using the round file. The sound level meter’s microphone wires will be running through this hole.

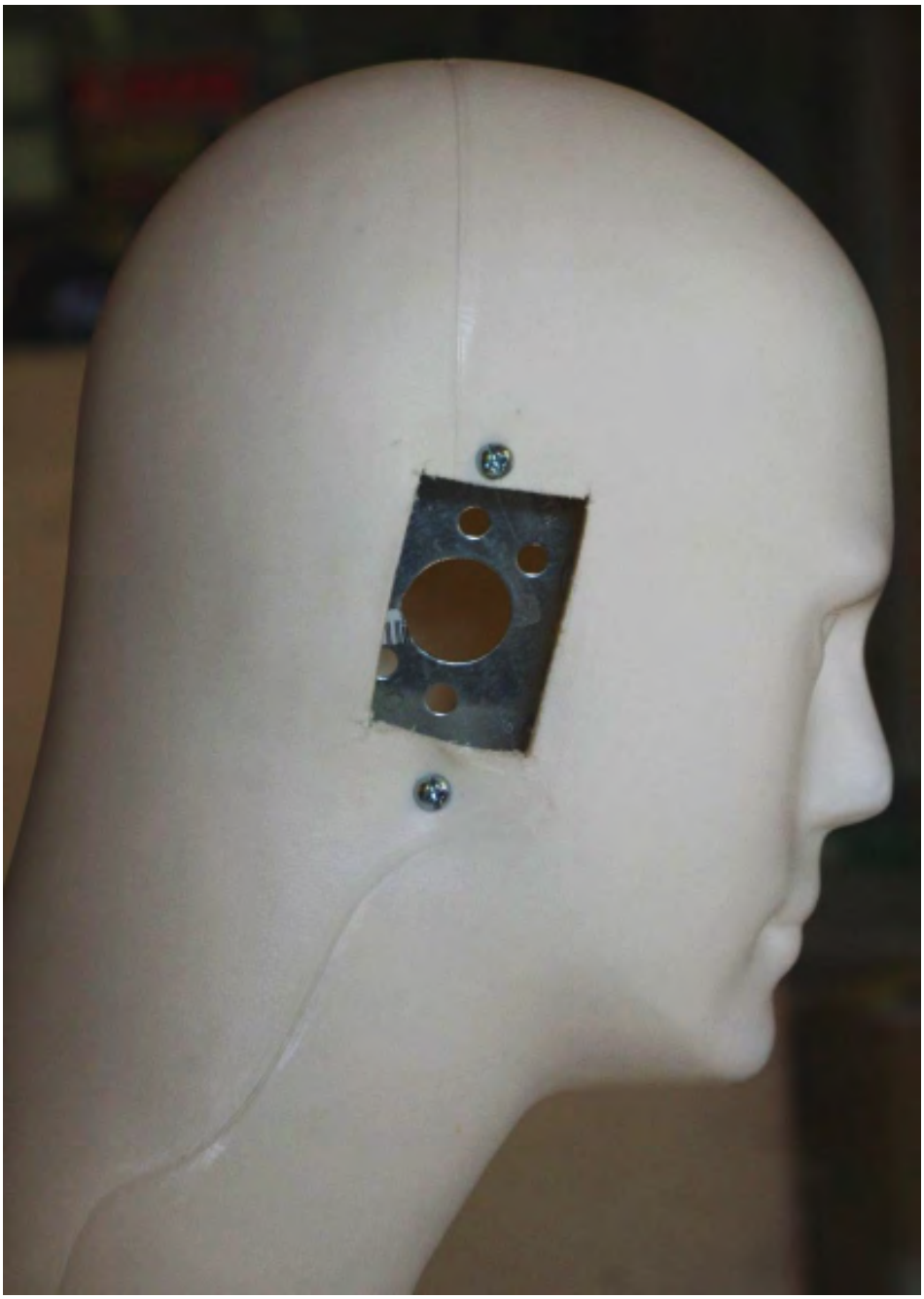
Hold the electrical box to the mannequin's head, over the hole you cut for the ear. The box should be centered on the cutout that you made so that you can't see any of the hole beyond the edge. Also, you will need to orient the electrical box so that the screw holes are outside of the boundaries of the cutout. The hole in the middle of the electrical box should be aligned just a bit lower than the middle of the cutout hole.

Use the center punch or a nail to mark the locations of the holes of the electrical box on the mannequin head (above), then drill two ¼" holes at the two marks (below).

Wake up your partner, as you'll need some help for the next step (unless you have very long and extraordinarily flexible arms). One person will need to maneuver the round electrical box through the neck, holding it to the inside of the head and lining up the two holes with the screw holes on the electrical box.

Next, install the two mounting screws that came with the electrical box to hold the box to the head. If the screws aren't long enough, use 1" 8-32 thread screws. You can use threadlocking compound to secure the screws, but it is not required.

Your mannequin should now look like this. Note the location of the electrical box center hole. You're now ready to start disassembling the sound level meter!



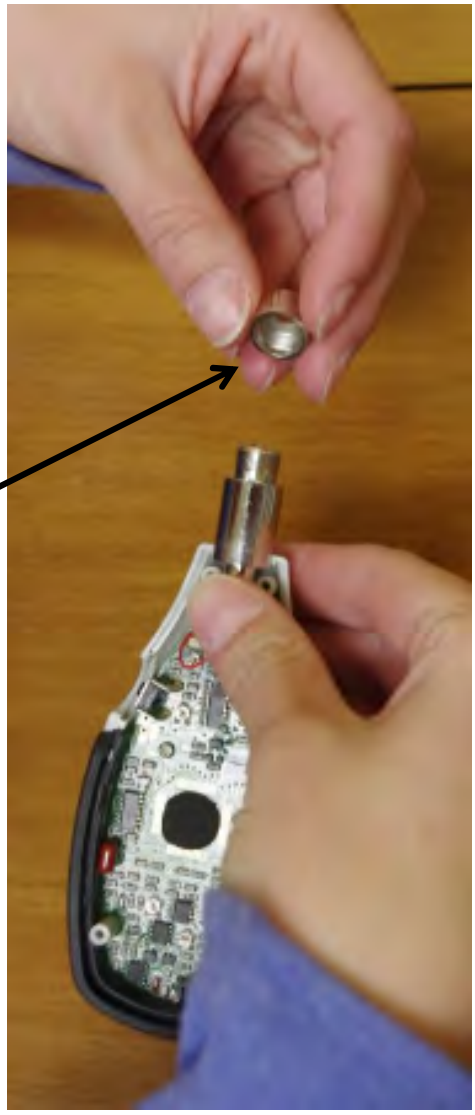
Step 3: Sound Level Meter Disassembly & Cable Wiring

Materials: Sound level meter, small Philips screw driver, soldering iron & electrical solder, instrument cable, wire stripper, needle nose pliers, glue gun. Optional: heat gun & heat shrink tubing.

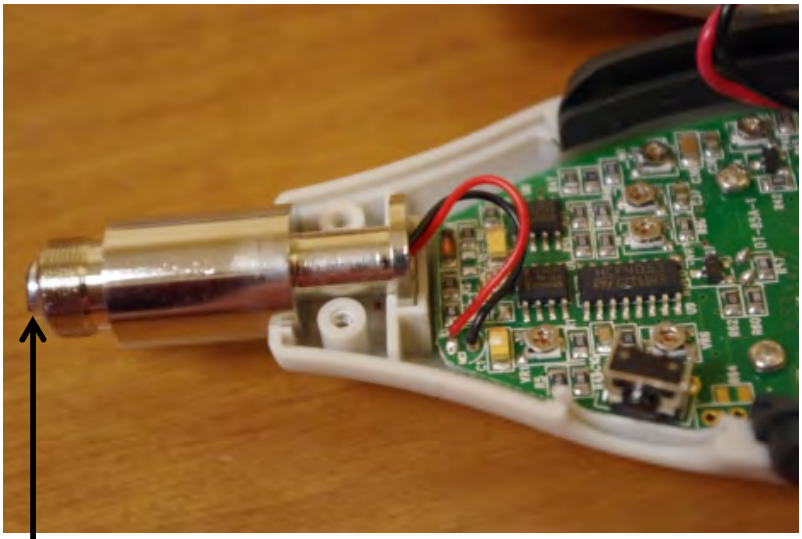
You will be carefully disassembling the sound level meter to remove the internal microphone element, replacing the microphone wires with wires from the instrument cable. If you have not had much experience with soldering, you should practice practice practice on something else. The internal wiring of the sound level meter is SMALL and the meter is easily damaged. You CAN do it, however!

First. use the small phillips screwdriver to open up the sound level meter. Remove the foam microphone filter (this can be discarded, unless you'd like to use it as a very small clown nose). There are 4 small screws holding the sound level meter together, two of which are hidden behind the battery door. After removing the screws, the two halves (front and back) of the sound level meter can be separated.

Here's the opened sound level meter. You can thread the battery connecter out from the battery slot to make it easier to work on the wiring if you would like.



Next, unscrew the microphone protector cap from the metal cylinder and set it aside. You will be putting it back on later.

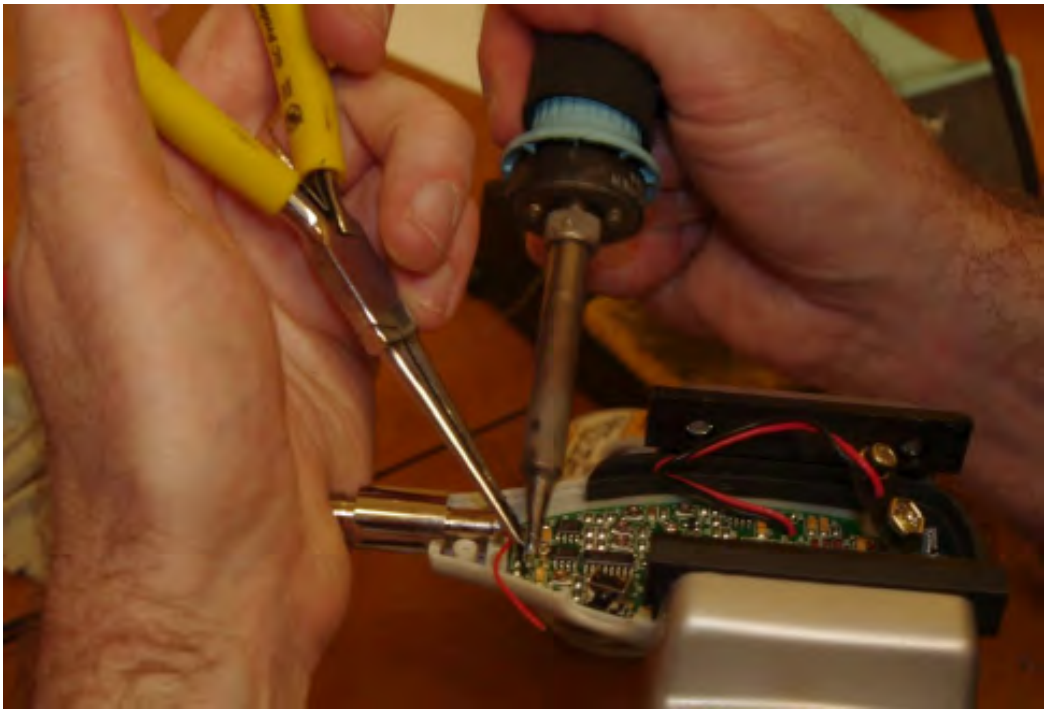


Here's a close-up view of the microphone at the end of the microphone cylinder. The red and black wires are the microphone connections. <u>Be careful with the microphone capsule as it is quite fragile</u>.

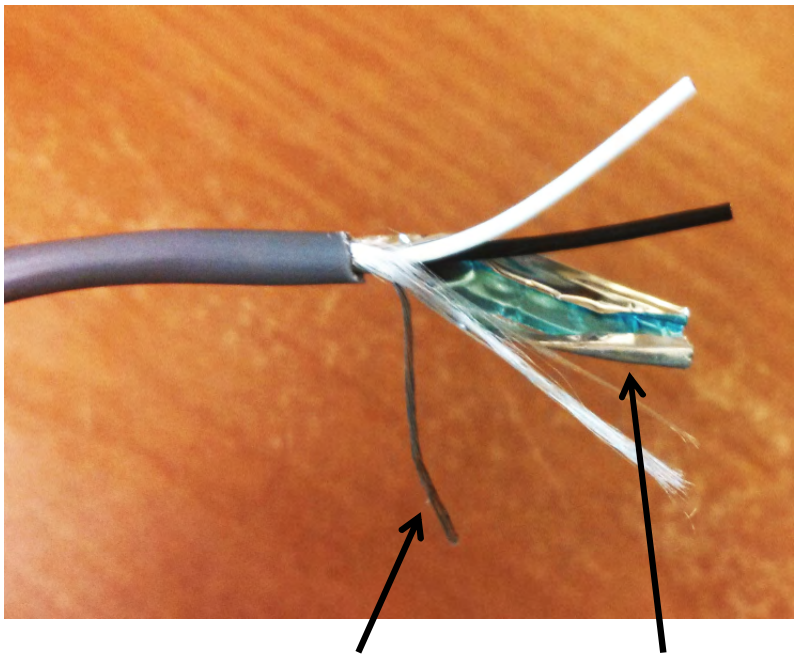
Remove the microphone: Use the soldering iron to loosen the connection of the red and black microphone wires to the circuit board. Write down which wire (red or black) is connected to which solder tab on the circuit board, as the microphone is polarized. The microphone is likely wired with the red connection closest to the microphone (top), but it's good practice to write down the connections just in case.

As you will be coming very close to the extremely hot soldering iron, it can be useful to employ the needle-nose pliers to hold the wires as you disconnect them. Make sure that you do not pull on the wires. The wires should come off easily when the solder melts. Also, make sure that the tip of your soldering iron is clean, as a dirty tip will heat up slowly, potentially overheating other components on the circuit board. Carefully remove the microphone and attached wires by sliding out of the silver protective cylinder. Set the microphone aside in a secure location.

For instruction on soldering, please see: http://electronicsclub.info/soldering.htm.



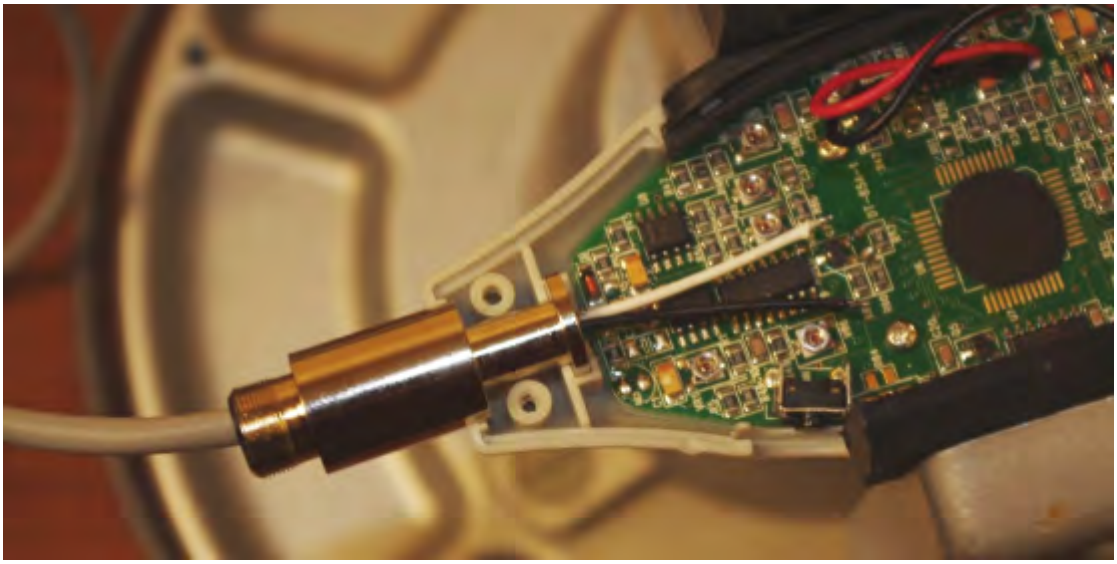
Next, measure and cut about 3-4 feet of the instrument cable and strip about 1” of the outer insulation from the cable with the wire strippers.



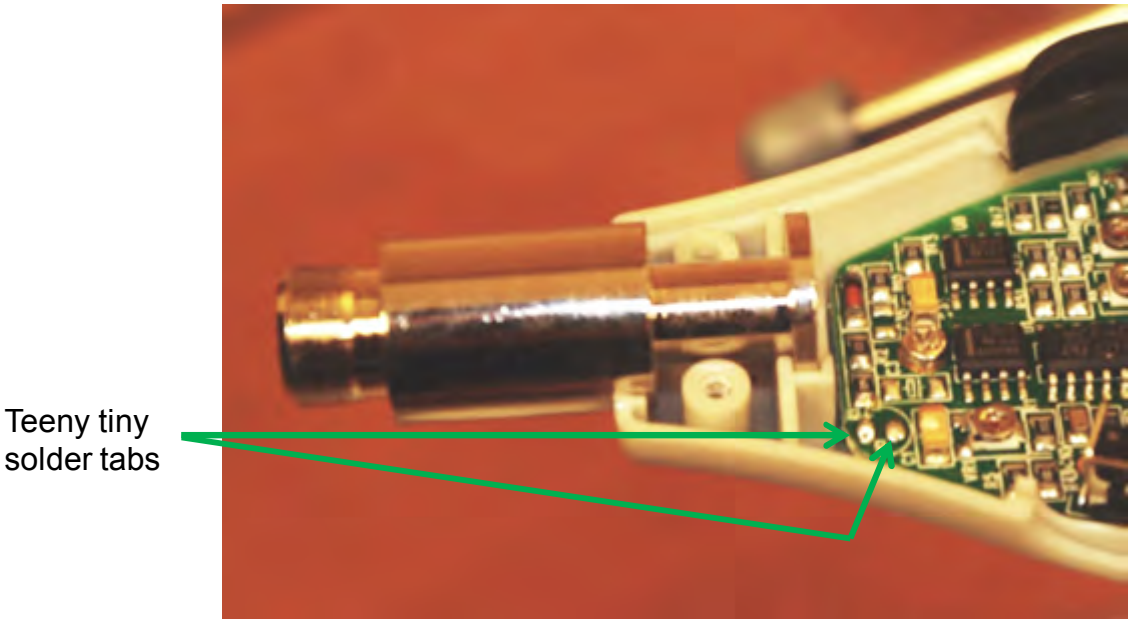
Cut away the uninsulated (bare) drain wire and silver foil grounding wrap if present.

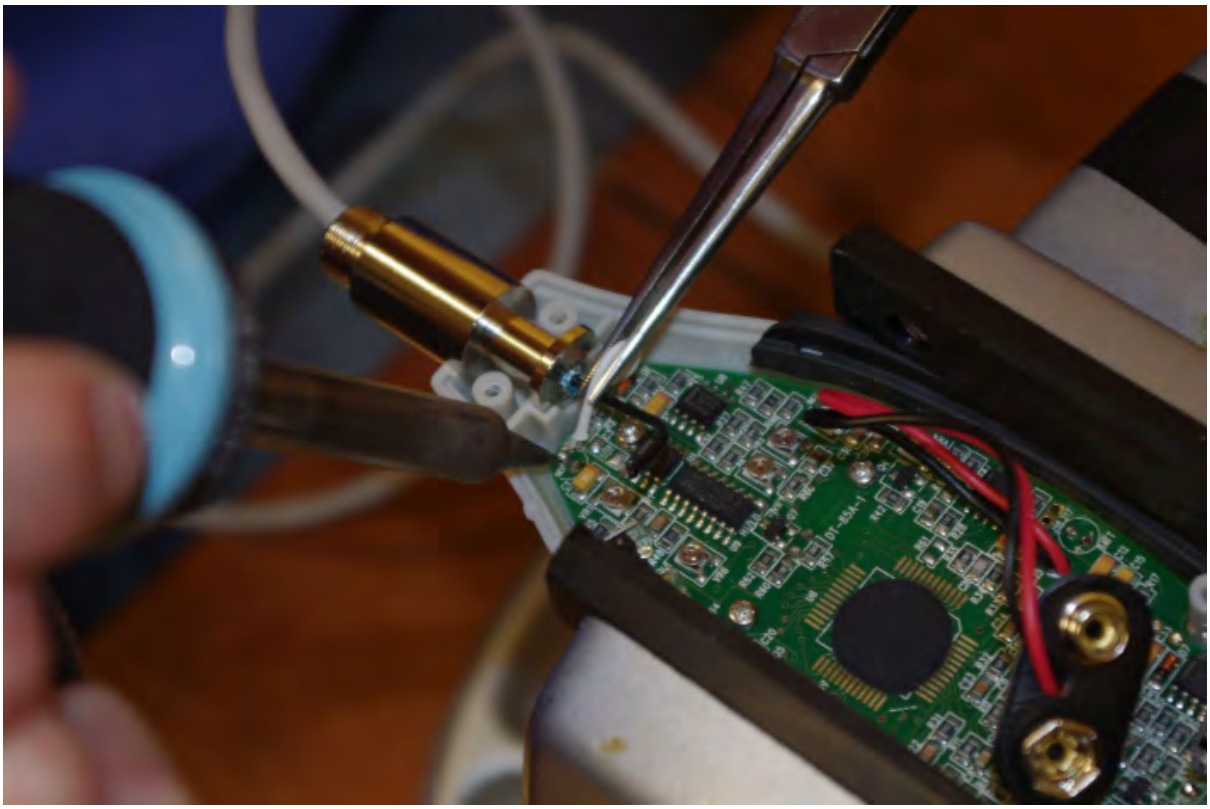
Strip about 1/8” of insulation from the white and black wires. “Tin” the stripped ends by melting a small amount of solder to them. Trim the wire ends so that only about 1/16” is exposed past the insulation..

Thread the cable through the metal microphone cylinder.



Twist the wires so that they line up with the two solder pads on the circuit board where the microphone leads were connected. Carefully solder the two wires to the solder pads, with the white wire closest to the microphone (taking the place of the red microphone wire). You probably won't need to add any more solder, as the tab on the circuit board will likely have enough on it already. Be careful not to smear the solder across the two tabs and ensure that the solder connections on the circuit board remain separate from each other.

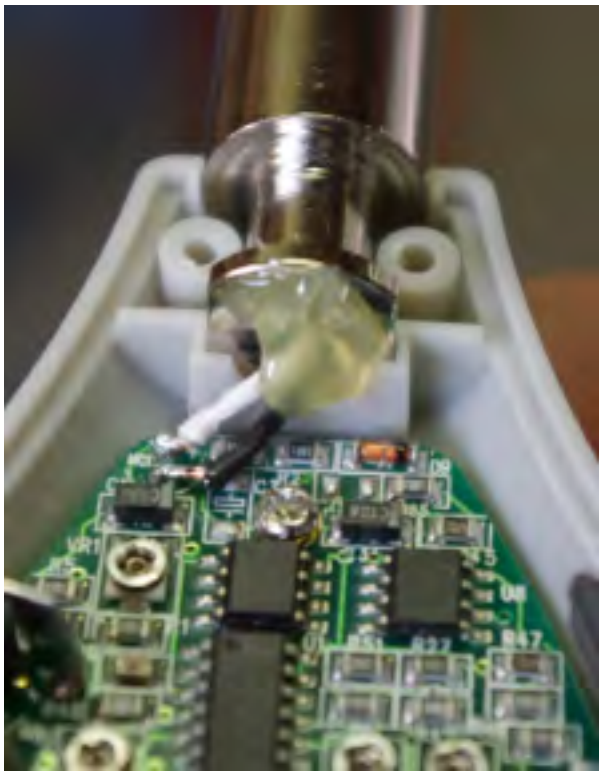




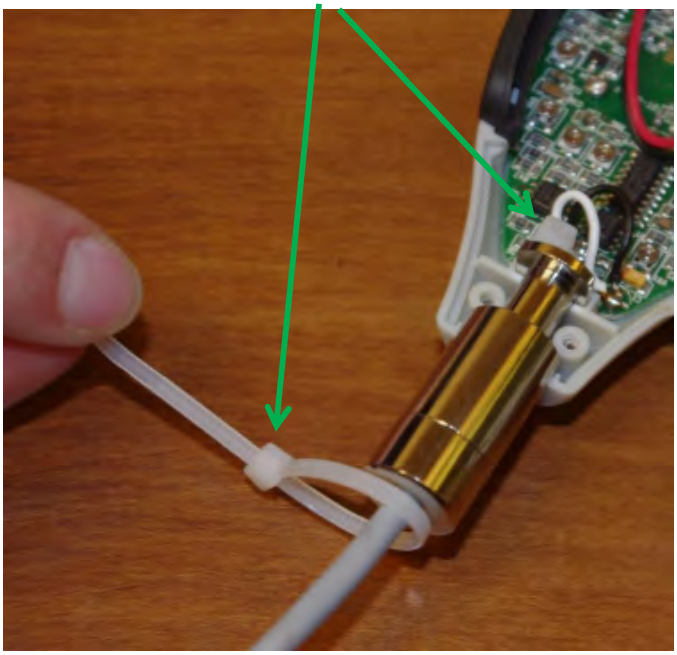
Reassemble SLM:

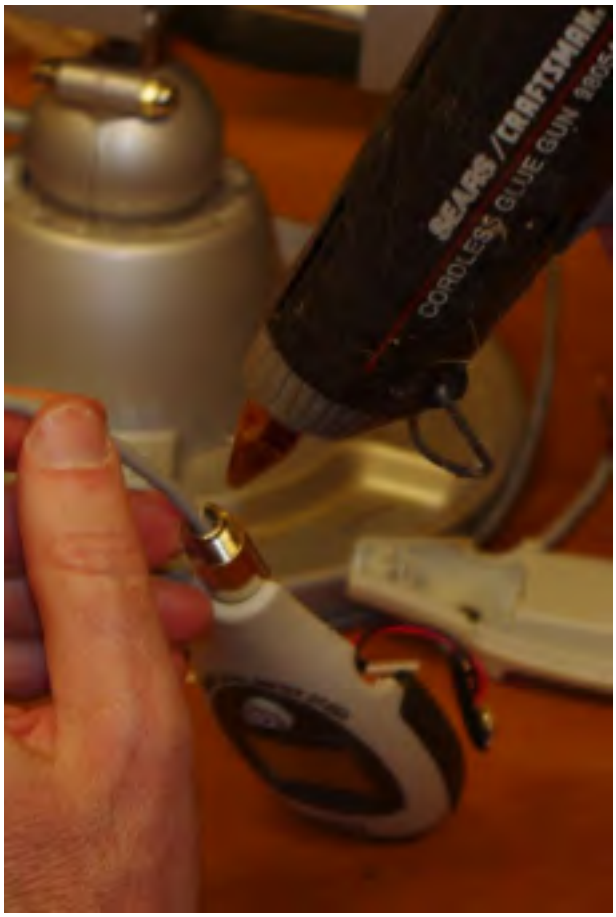
Use the glue gun to apply a blob of glue to the cable & wires at both ends of the metal microphone cylinder to act as a strain relief. Try to get the glue to flow down the metal cylinder. A zip tie at each end of the cylinder can also be used for this purpose (bottom left picture).

Screw the silver protective cap back onto the end of the cylinder.



Zip ties

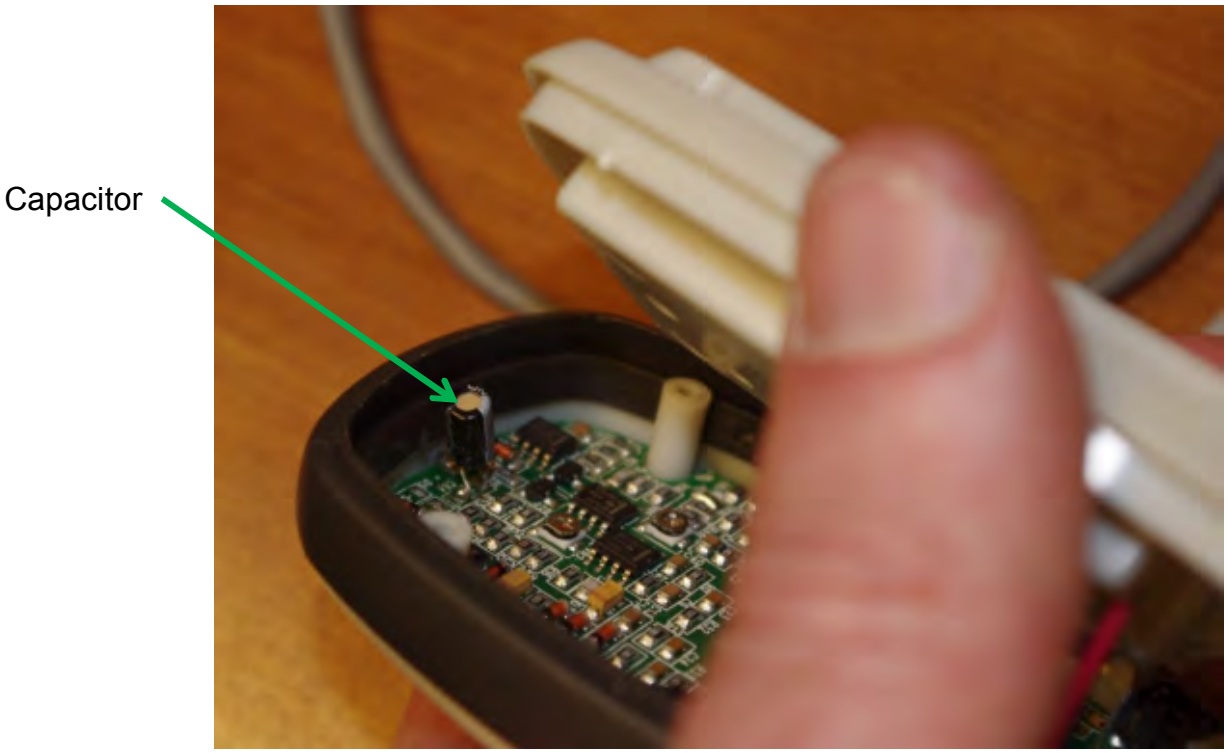




Reassemble SLM:

Press the two halves of the sound level meter case together. You may find that the rubber gasket or the “Max” button has become dislodged during the wiring process. These pieces just fit within slots on the case.

CAUTION: There may be a can capacitor sticking up from the base of the circuit board. This capacitor needs to fit just below the battery compartment.



Optional: The SLM provides a decibel measure to the tenth decimal. You may find it easier to put tape over the last digit to make the decibel level more simple to read for children.

Step 4: Connect the ¼" TS phone jack to the SLM cable.

Materials: Soldering iron & electrical solder, instrument cable, wire stripper, needle nose pliers, glue gun, ¼" phone (TS) plug & jack, electrical tape, wire ties. Optional: heat gun & heat shrink tubing.

The SLM will be connected to the phone (TS) plug. Unscrew the cover of the plug & slide the metal cover and the plastic insulator over the cable before soldering any connections.

Strip the end of the cable coming from the SLM, trimming the white and black wires so that they reach the plug's solder tabs with no extra wire. As before, trim the foil and drain wire, wrapping the end of the cable in electrical tape or heat shrink tubing as shown.

Strip approximately 1/16" of insulation from the white and black wires, tin them with solder, tin the solder tabs on the plug, then solder the white wire to the small tab on top of the connector. The black wire will be soldered to the longer "base" plate.

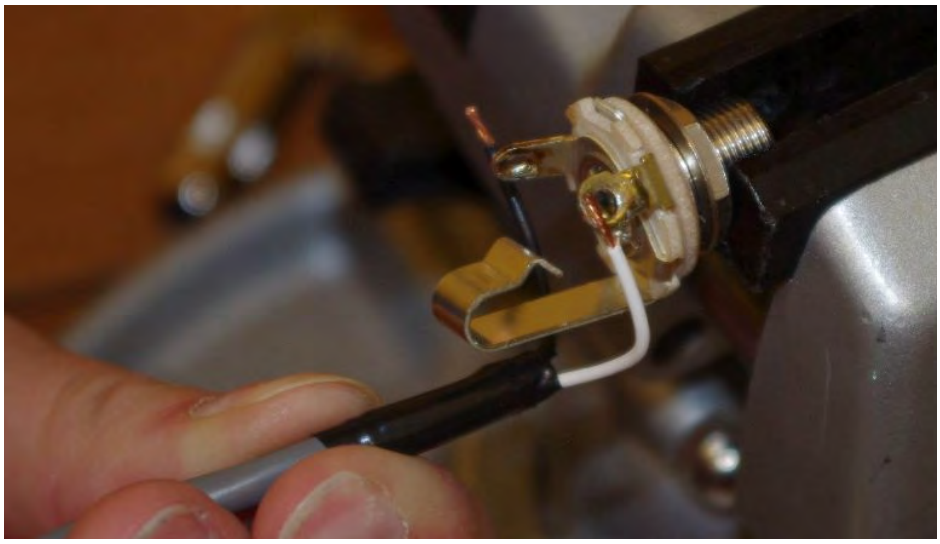
After making your solder connections, secure the cable to the plug by crimping the two cable tabs as shown. Slide the plastic insulator over the assembly and tighten the cover.

Step 5: Making the microphone connections.

Materials: Soldering iron & electrical solder, instrument cable, wire stripper, needle nose pliers, glue gun, ¼" phone jack, electrical tape, wire ties. Optional: heat gun & heat shrink tubing.

Cut a second 3' length of the instrument cable, stripping the insulation as before. Strip and tin approximately 1/4" from the white and black wires on one end of the cable. Remember to cut the foil shield and the bare drain wire and to tin the bare wire with solder. Tape the ends of the cable (or use heat-shrink tubing) to cover the end where the foil shield ends. This end of the cable will connect to the phone jack that will go inside the mannequin.

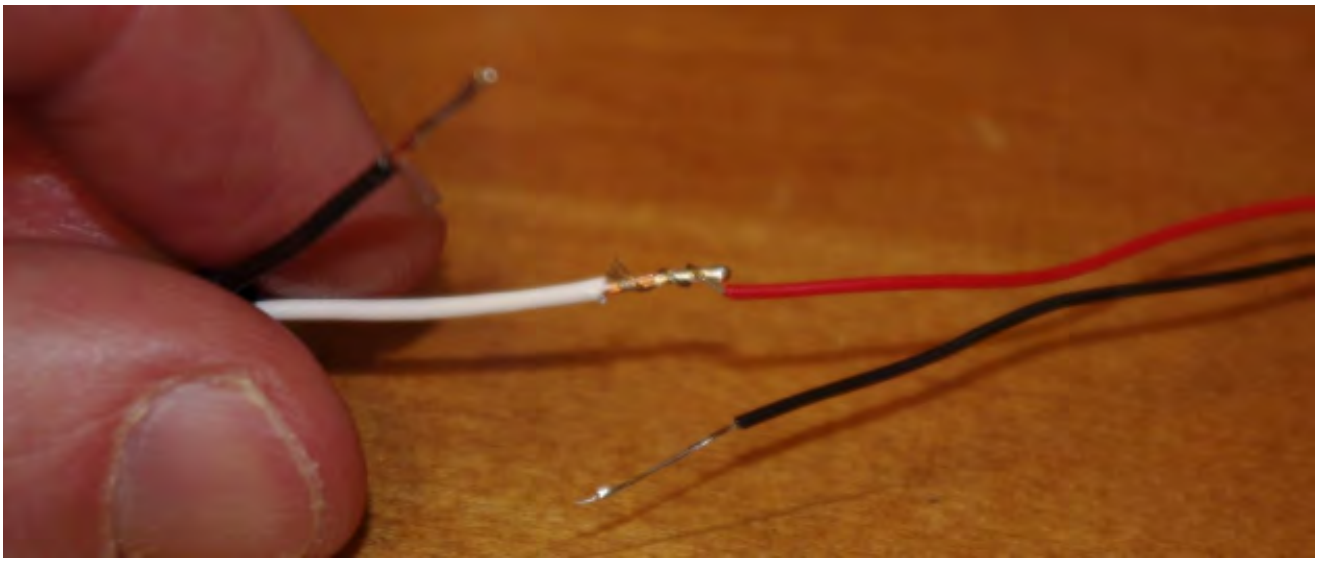
Tin the two solder tabs on the jack then solder the white wire to the tab that is connected to the long bent plate (see below figure). The black wire will be soldered to the tab that connects to the threads.

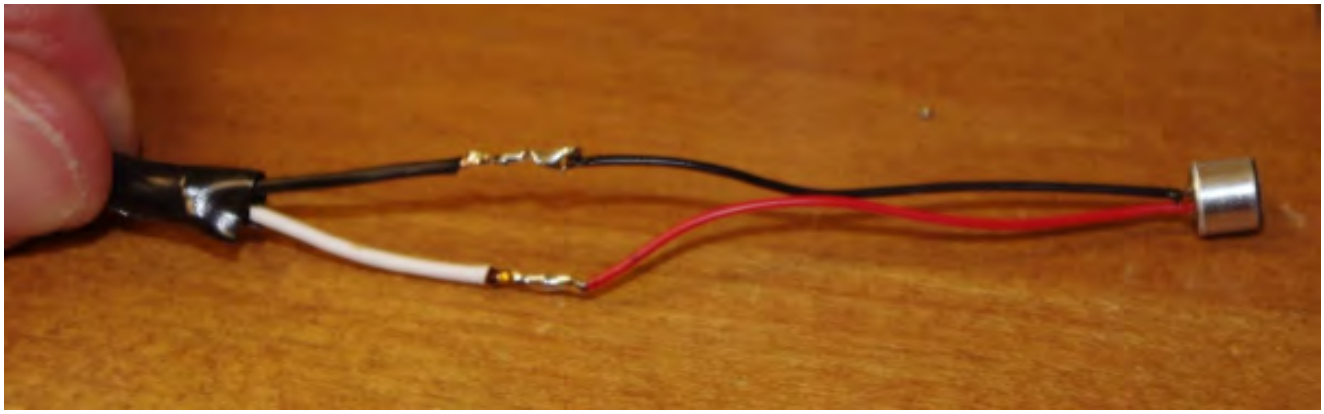


After making your solder connections, secure the cable to the jack with a zip tie as shown.

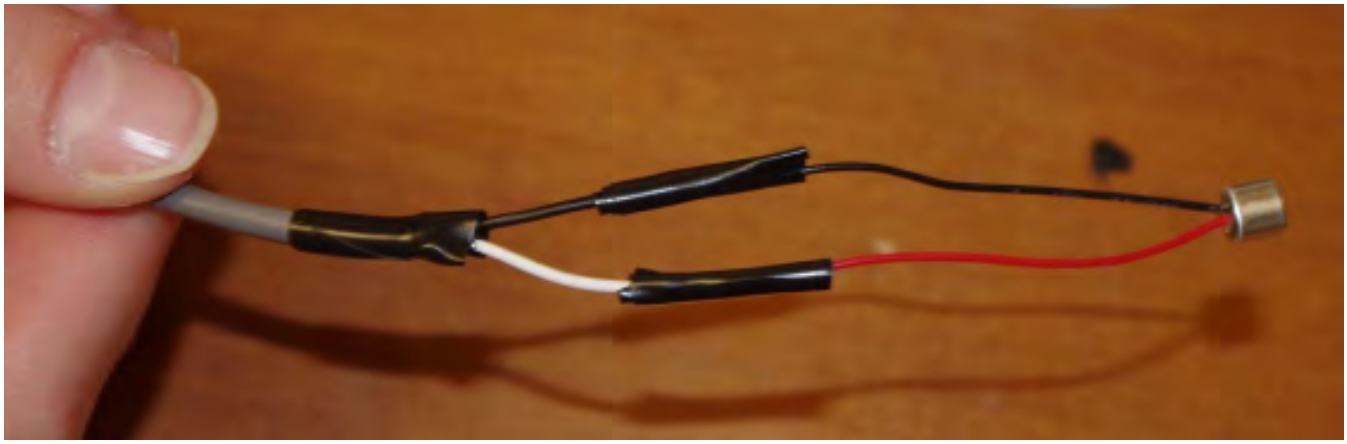
At the other end of the cable, strip about 2” of cable insulation and strip and tin approximately 3/8” from the white and black wires. Carefully strip about 3/8” of insulation from the red and black microphone wires, being careful not to pull on the microphone element. Tin these wires as well, and then twist the red microphone wire around the white cable wire and black to black. Solder these connections (you may need to add a bit more solder).

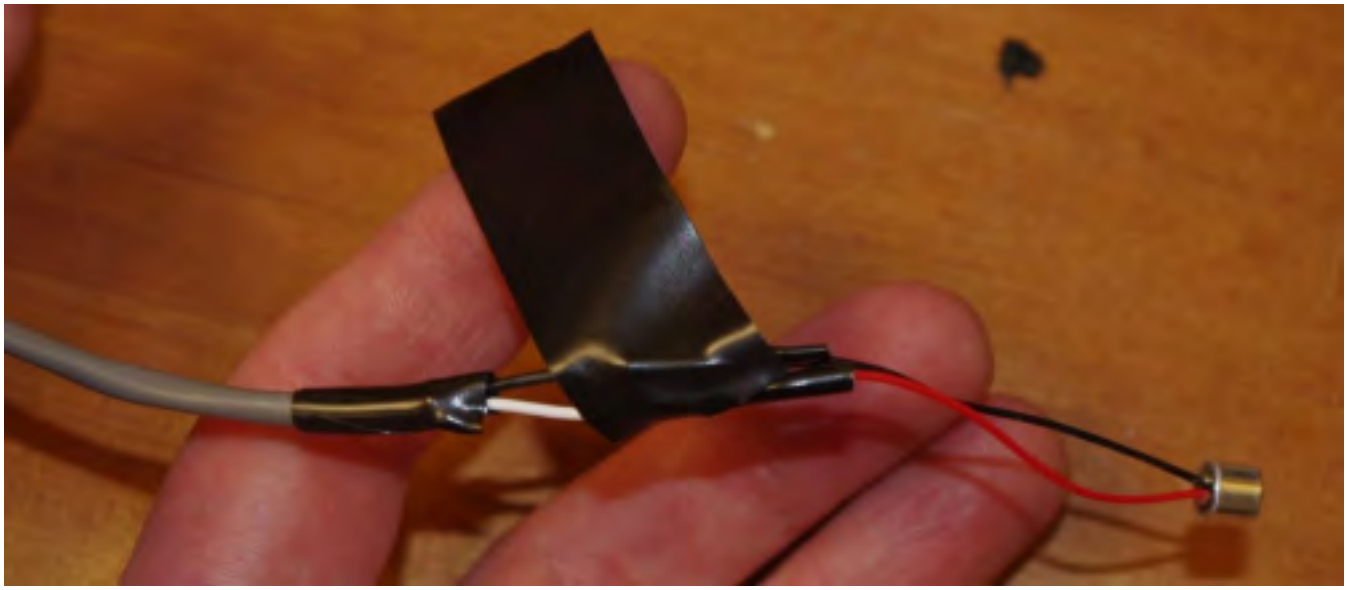
Optional: If you are going to use heat shrink tubing to insulate these connections, cut about ½” of size 1/8” diameter tubing and place it on the red and black wires BEFORE soldering. It’s way too easy to forget to put the heat shrink tubing on first. We know from experience.

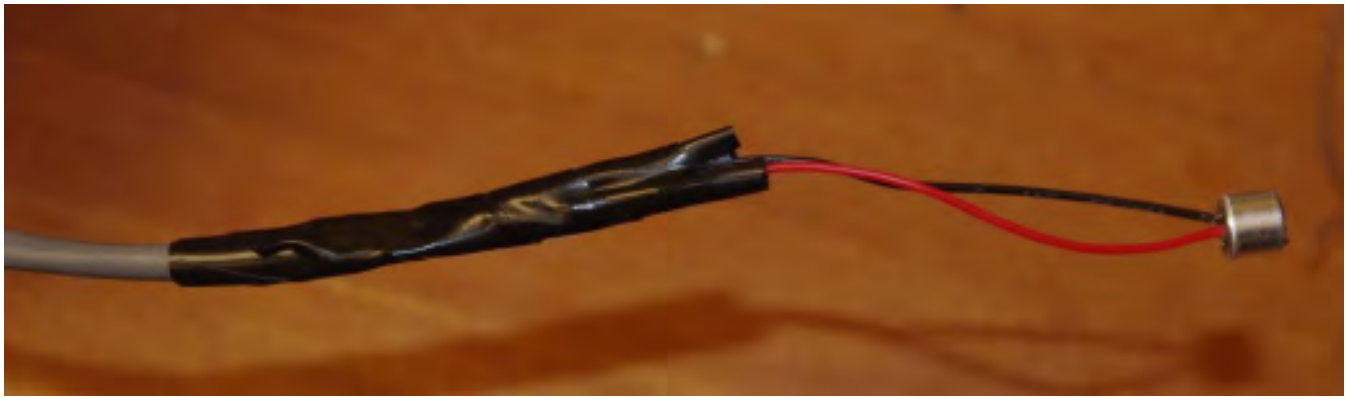




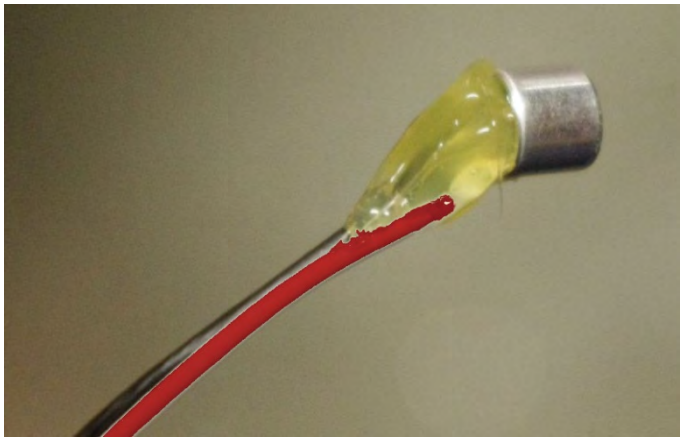
If you are not using heat shrink tubing for insulation, wrap electrical tape tightly around each connection, and then around the cable itself. If you do use heat shrink tubing for insulation, insulate each connection and then wrap the cable with a larger piece of tubing to secure.







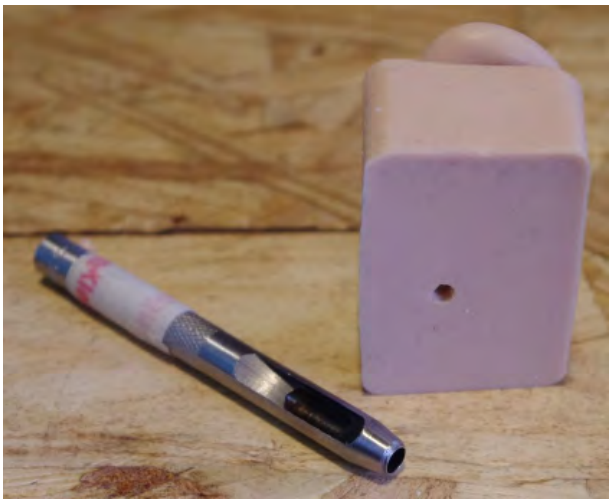
Next, place a small blob of hot-melt glue on the back of the microphone, where the wires are connected. This will help to ensure the wires do not pull off of the microphone.



The finished microphone cable!

Step 6: Cutting the microphone hole in the ear
Materials: Silicone ear and hollow hole punch (3/16", but ¼" can work well also).

Place the hollow hole punch in the ear canal of the silicone ear, pressing down while turning. Place the ear on a hard surface that you don't mind scratching, as the punch will cut through the ear and into whatever is below.



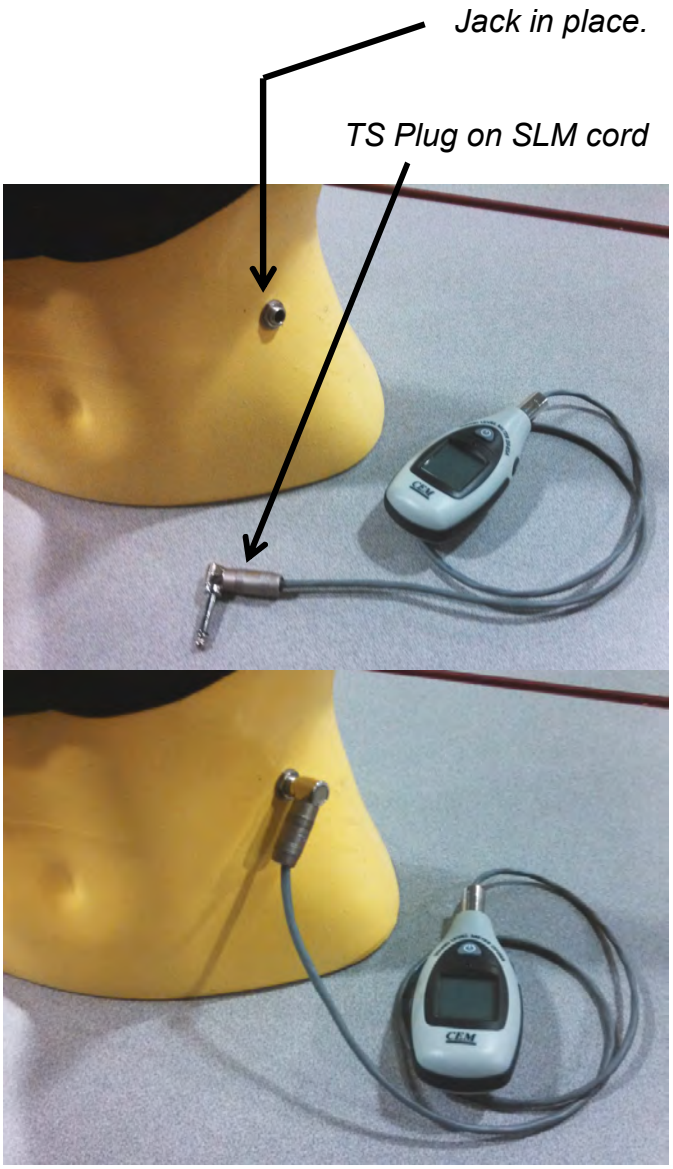
Step 7: Painting
Materials: Spray paint, newspaper

Before installing any wires or the ear is the time to paint. If the mannequin has cracks, you may be able to fill them in with hot glue or epoxy. Get a can of a bright color spray paint for plastic (it should say “no primer required”). Make sure you wipe the mannequin down with a moist paper towel to get rid of any dirt and dust. Paint the dry mannequin in a well-lit, well-ventilated area and line the floor with newspapers. Hold the can about 12” from the mannequin and apply a thin even coat with the color paint. Wait for the coat to dry and repeat this 3 to 4 times, making sure you fill in all the white spots and cracks. It is also recommended that you add a coat or two of clear gloss over the color paint to protect against chips and scratches.

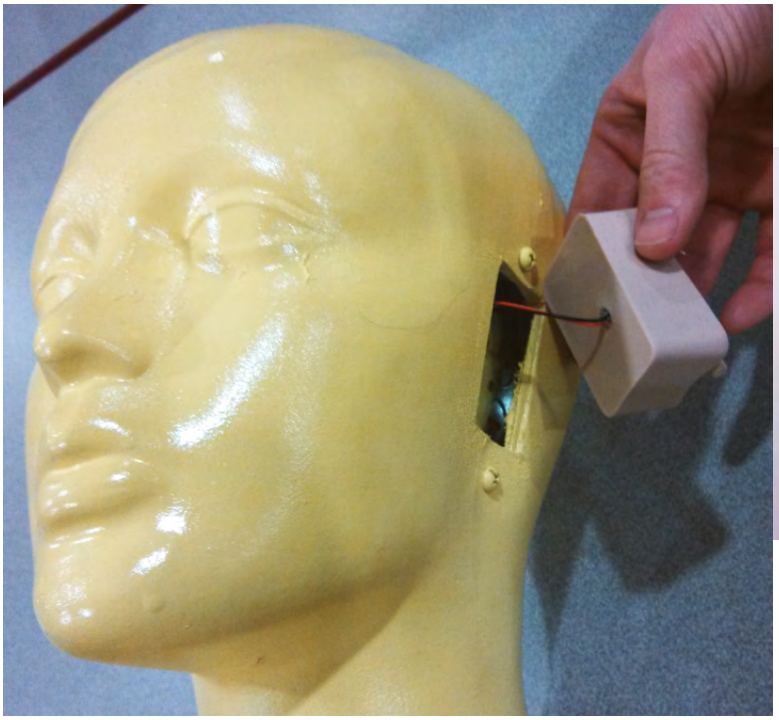
Step 8: Installing the cabling and ear
Materials: Drill & 3/8" bit, adjustable wrench, duct tape.

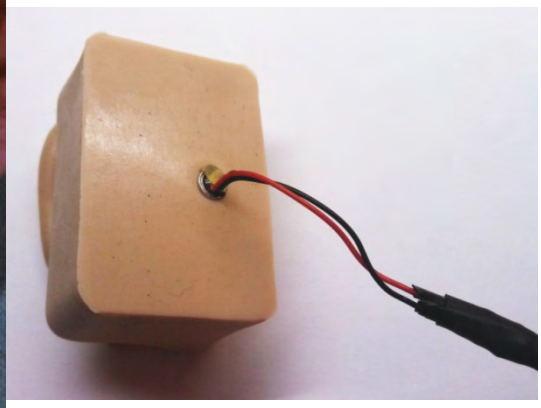
Find a suitable location to place the ¼" phone jack (often under the pectoral area or the lower abdomen works nicely) and drill a 3/8" hole to accommodate the phone jack. You may want to drill this hole prior to painting.

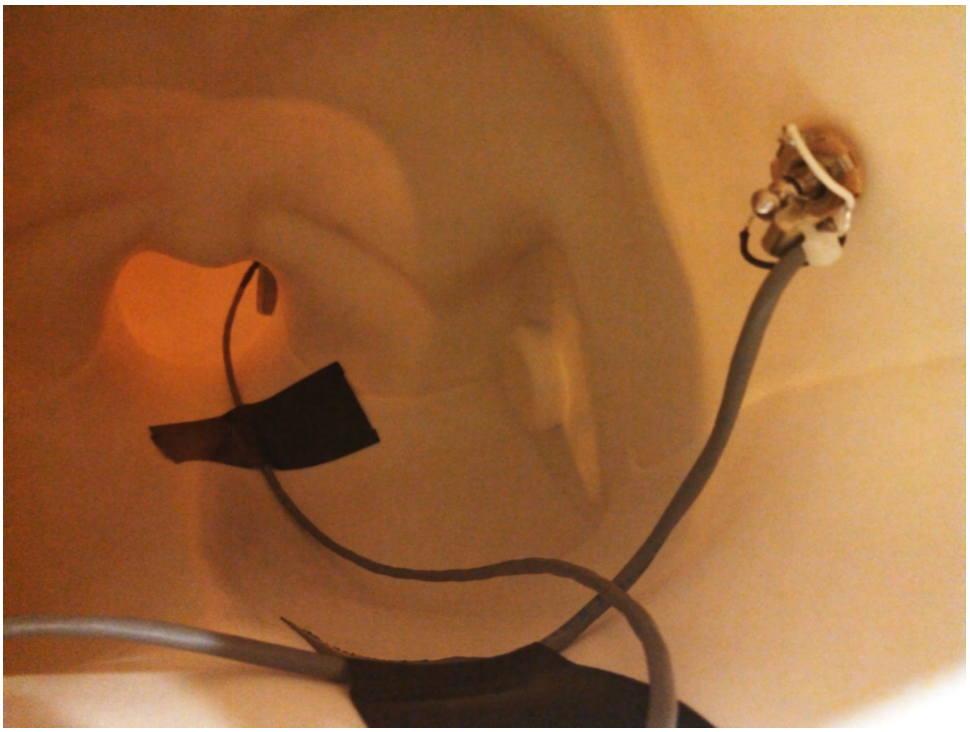
Place the phone jack in the hole, tightening the nut from the outside (you may need to carefully hold the jack inside the mannequin as you tighten the nut to prevent it from spinning).



Thread the microphone cable through the neck and out the hole in the electrical box. Carefully push the microphone into the hole in the silicone ear, then place the ear in the ear cutout. Use duct tape to secure the cable inside the mannequin, but leave enough free cable at the head so that the microphone and ear can be taken out if necessary.







View from inside showing the plug in the jack and the cable taped to the mannequin.

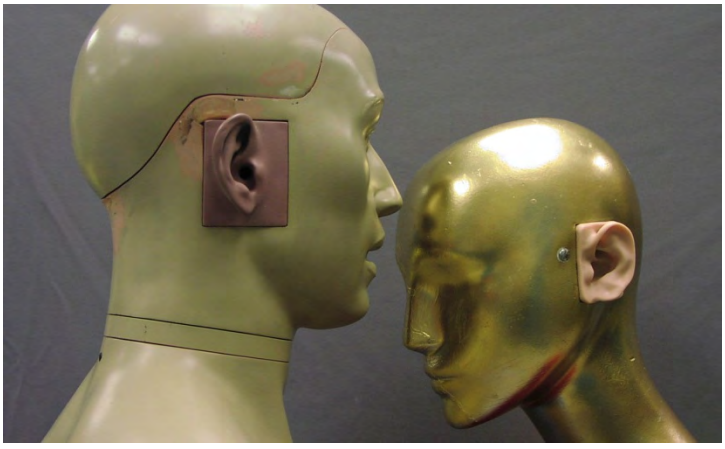
Special calibration note

The shape of the human ear canal changes the sound waves as they enter the ear. This results in resonance peaks of energy in the spectrum of those sounds. As a result, the total energy reaching the eardrum may be different than that recorded outside of the head. Several health safety organizations like NIOSH (National Institute of Occupational Safety and Health) have developed their own recommend exposure limits for sound (http://www.cdc.gov/niosh/docs/98-126/pdfs/98-126.pdf). These standards were developed using sound measured in an open area or a diffuse-field, not in an ear canal.

These occupational noise exposure standards are measured from the shoulder rather than from inside the ear canal. We have to account for this difference in our measurements in order to use the preset noise exposure recommendations set up by NIOSH and other groups. To do this we needed to figure out how different Jolene's in-the-ear sound level measurements are from the NIOSH guidelines so that we can accurately correct for the difference. This is called finding the "transfer function for the outer ear" or the "TFOE." The TFOE for Jolene is approximately +5 dB for all headphone and ear bud types except ones that fit tightly inside the ear canal (also known as "insert earphones"). This means that the reading you get from the sound level meter on your Jolene will be **5 dB higher** than its corresponding measurement on the NIOSH chart. In order to use NIOSH recommended exposure limits (e.g. 85 dBA for 8 hours), just subtract 5 from the SLM reading on your Jolene. For example, if your Jolene SLM gives you a reading of 96 dB, you should subtract 5 dB and reference 91 dB on the NIOSH recommended daily exposure chart (pg. 42).

This is **only an approximation**, but it gives a reasonable estimate of how much sound energy is actually getting into the ear when someone uses headphones. Remember, the risk of noise-induced hearing loss is determined by sound level AND duration of repeated exposures over extended periods of time.

The TFOE that we measured was validated by Elliott Berger, Division Scientist at 3M (Berger, E.H., Mergerson, S.C., Stergar, M.E., Personal music players: Are we measuring the sound levels correctly? ASHA Leader 14(10), p. 14-17, 2009.). For a great explanation of TFOE see: http://www.asha.org/Publications/leader/2009/090811/f090811b.htm



Step 9: Clothes and accessories

Now you get to pick out the wardrobe and accessories. Be creative. Make your Jolene a special creation. You can find cheap, fun clothes for your mannequin at any local thrift shop. We bought Jolene's clothes at Goodwill. Don't forget to have fun naming them!

Step 10: What to do with Jolene?

Use Jolene for education. Take her to science fairs, public events, to school, parks, camps. Basically, any place where people can be found using personal stereo systems. Jolene will get attention and allow you to explain information about hearing, noise exposure and safe listening levels for personal stereo systems.

Use Jolene for research. Conduct your own studies of how people use their personal stereo systems. Make recordings of typical listening levels and ask people about how they use their systems and about their understanding of noise levels and what can or can not cause hearing loss.

Use Jolene for marketing and recruiting. Audiologists may use Jolene for community outreach and opportunities to promote their clinical service. University training programs may use them to generate student interest and recruitment into the fields of acoustics, audiology, physics, industrial hygiene, engineering etc. Electronic stores may want to offer a public event to promote their music listening products. Be creative, almost anywhere that people go, Jolene can go!

Find us on Facebook

Find Jolene Ohsu on Facebook!
https://www.facebook.com/jolene.ohsu

NIOSH: Recommended Exposure Limits (REL)

http://www.cdc.gov/niosh/docs/98-126/chap1.html#table11

This is a list of the recommended maximum daily noise exposure limits for workers as determined by the National Institute of Occupational Safety and Health (NIOSH). On the left are the sound pressure levels (in decibels) and on the right is the amount of time you can listen to a sound at that level before it begins to damage your hearing. For example, during a 24-hour period, a worker can listen to a 100 dBA sound for 15 minutes before it becomes dangerous. The actual allowable exposures for hazardous sound exposure over a lifetime are not known, however these occupational guidelines provide a good reference point for teaching about safe listening
* These exposure guidelines assume there are no other sources of hazardous sound exposures encountered during the same day.

Time-Weighted Average =100% Dose	Duration of Exposure
120 dBA	< 10 seconds
115 dBA	< 30 seconds
112 dBA	<1 minute
109 dBA	<2 minutes
106 dBA	<4 minutes
103 dBA	7.5 minutes
100 dBA	15 minutes
97 dBA	30 minutes
94 dBA	1 hour
91 dBA	2 hours
88 dBA	4 hours
85 dBA	8 hours

To apply the NIOSH recommended exposure levels to the readings you get from Jolene, you should subtract 5 dB from the reading on your sound level meter. For example, if you get a reading of 96 dBA from your measurement, you should use 91 dBA on the table to the left to determine the maximum safe listening time at that volume for the day.

The Jolene Family Album:

There are now Jolene's all over the world as noted in red below. Email a photo of you and your Jolene, and a description of who and where you are to dd@ohsu.edu and it will be included in the family album on the Dangerous Decibels website www.dangerousdecibels.org. Keep us updated on your activities by setting up your own Facebook page and posting your activities.

Here are just a few of Jolene's siblings and where they live:

Butch
Springfield, UT

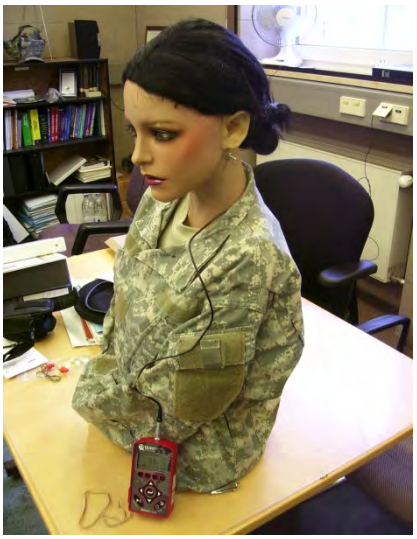
Roxie
Boston, MA

Günter
Greeley, CO

The Jolene Family Album:

Nick
Cincinnati, OH

Tim Panic and Kallie Bration
American Academy of Audiology



Elle Queue
US Military Bases in Europe

Alex
Mexico, NY

Shocque
Burlington, ONT, Canada

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