Let’s get started
This guidebook has all the instructions you need to make three projects using the Touch Board, Electric Paint and Printed Sensors.

Components glossary
A guide to what you get and what it’s for:
About
Definitions and resources for Electric Paint, Touch Board and Printed Sensors.
Printed Sensors - MIDI
Paper Orchestra Creating paper instruments to compose a tune.

Electric Paint - Memory Game
Painting an interface to play an interactive memory game.

Capacitive Sensing - Interactive Posters
Plan, design, make and program interactive posters.

To find online versions of these tutorials including video, please visit bareconductive.com/make

Share your project
@bareconductive

Electric Paint
Your design and electronics projects are about to change forever. Paint circuits and sensors to trigger sounds through its MP3 player. Use our cross-platform installer to add loads of code examples to the Arduino IDE.

Key Features
- Conducts electricity when dry
- Paint, stencil or screen print
- Non-toxic and solvent-free
- Water soluble
- Paint over with water-based paints
- Electric Paint 10ml dispenses up to 5m
- Electric Paint 50ml screen prints up to 0.8m²

Touch Board
One tool, a million possibilities. Create sensors with its 12 electrodes to trigger sounds through its MP3 player. Use our cross-platform installer to add loads of code examples to the Arduino IDE.

Key Features
- Capacitive touch and distance sensing
- Arduino compatible
- No programming required
- Code and libraries for the Arduino IDE for optional programming
- MP3 Player / MIDI device
- MicroSD card socket
- Standard 3.5mm audio socket
- LiPo battery charger
- USB HID compatible
- USB MIDI compatible
Instrument Sensors
These sensors have been pre-printed in the shape of an instrument with Electric Paint, and coated with a clear seal making them smudge and water resistant. This means you can start playing music immediately. Every sensor has exposed (unsealed) nodes, which can be connected to the Touch Board.

Printed Sensors
Test your ideas quickly without needing to cut or remove your Touch Board. Each hub has 4 USB sockets so you can plug in a USB Hub to the Touch Board, and to upload code via the Arduino IDE.

MicroSD card
The microSD card allows you to store MP3 files on your Touch Board. Using the microSD card reader you can view and change the MP3 files on the card. The microSD card is used to store MP3 files, and you can use it to send data to and from the Touch Board.

Electric Paint
Electric Paint is a nontoxic, water-based, conductive paint. It uses carbon black as a conductor so it’s not metal based. Electric Paint is a unique material that can be applied in many different ways, from a paintbrush and stencil to common printing processes like screen-printing. To achieve consistent electrical performance, it is best to apply Electric Paint in an even layer. It is not inkjet printer compatible. Electric Paint can be removed with water.

MicroSD Card Reader
This speaker is light, portable, and USB chargeable. The Touch Board has an on board audio socket so you can plug in a speaker, or connect your own speakers or headphones if preferred.

USB Hub
Use the USB hub to power your Touch Board. Each hub has 4 USB sockets so you can connect up to 4 devices at once.

Micro USB cable
The Micro USB cable allows you to power your Touch Board directly from your USB hub. When connected to your computer, you can use it to send data to and from the Touch Board, and to upload code via the Arduino IDE.

Sticky Tabs
Use these tabs to mount your Touch Board or sensor cutouts to a wall and make sure they stay in place.

Velcro Stickers
Mount your speaker easily to the wall and detach for charging. Use these if you are building a vertical project, or if you want to secure the speaker in place.

ADVANTAGES / PRODUCT BENEFITS

- Electroconductive
- Non-toxic
- Water-soluble
- Compatible with standard printing processes

COLD SOLDERING
Electric Paint can work well as a cold solder joint. Whether used to solder a surface-mount or through-hole component onto a circuit board, or to adhere a component to a piece of paper. This material is almost infinitely repairable. These unique properties mean that components can be harvested from projects, cleaned and reused.

DRIED
Electric Paint dries at room temperature, and gives off no fumes during the drying process. Drying time can be reduced by placing the material near a low intensity heat source.

CONDUCTIVITY
Electric Paint contains conductive carbon particles which come into contact when water evaporates from the material, making it conductive when dry. When powered, Electric Paint can hold an electric charge to create a capacitive sensor, or allow an electric current to flow.

POWER SOURCES
Electric Paint is designed for use with low voltage DC power sources at low currents and has not been tested with sources exceeding 12VDC at 50mA. Higher voltages are not recommended.
Search: seal Electric Paint.

Search: screen print

Screen print with Electric Paint to create graphics and sensors. This is a simple method you can use to apply an even and thin layer of Electric Paint onto a flat surface. With this method you create multiple copies of the same image or highly precise graphics. This tutorial shows how to use a stencil with your screen.

Search: stencil

Create a tape stencil for Electric Paint

Using Electric Paint to create slick graphics is easy, even if you don’t have screen printing equipment. This tutorial provides some tips on how to use a stencil with Electric Paint. You'll get a quick demonstration on how you can use a stencil or create your own using masking tape.

Search: stencil

How to cold solder

Cold soldering is a great alternative to traditional soldering and doesn’t require a solder iron. All you need is Electric Paint. In this tutorial, we’ll demonstrate how to cold solder onto the Touch Board and other materials.

Search: cold solder

How to seal

Electric Paint is a water-based paint, which means that it is easy to wash off, but also prone to smudging – even when it's dry. By sealing the paint, you will protect Electric Paint. The tutorial shows you how to use a clear coating to seal Electric Paint.

Search: seal

How to screen print with Electric Paint

Search: screen print

Touch Board

Capacitive sensing is a proximity sensing technology. Capacitive sensors work by generating an electric field and detecting nearby objects by sensing whether this field has been disrupted. These sensors can detect anything that is conductive or that has a significantly different permittivity than air, like an animal, human body or hand.

Search: screen print

The Touch Board is a microcontroller with 12 dedicated capacitive touch sensors electrodes. It can be programmed using the Arduino IDE, and can be recognised by a computer as a USB HID device, a keyboard, MIDI device, serial and more.

Search: screen print

PRODUCT FEATURES

- Capacitive touch and distance sensing
- Arduino compatible
- Code examples and libraries for the Arduino IDE
- Pin layout supporting Arduino shields
- HID and MIDI capable

Search: screen print

TARGETS

The Touch Board’s electrodes can detect a range of targets all the way from the touch of a fingertip, to a drop of water, or the proximity of a whole person. This target detection can be optimised through a combination of electrode calibration and sensor design.

Search: screen print

ELECTRIC PAINT

Electric Paint can be used alongside the Touch Board to extend its electrodes and create sensors beyond the hardware. The paint can be applied to most materials – free-hand using the Electric Paint tube, or with a paintbrush. Electric Paint can also be printed to create thin, flexible, low-cost sensors. This material and hardware combination is a powerful toolset to integrate capacitive sensors into the environment.

Search: screen print

PROGRAMMING

The Touch Board can be programmed using the Arduino IDE just like any Arduino board. We use the Arduino platform because it is easy to understand for people who have not programmed before, while still allowing advanced users to write sophisticated programs. We have a library full of code examples so that getting started with more complex projects is easy even for those with very little programming background.

Search: screen print

Resources

www.bareconductive.com/tutorials
What is distance sensing?

Although it’s called the Touch Board, what the electrodes are really doing is sensing proximity via capacitive sensing. When you set a sensor’s thresholds to be relatively high, the Touch Board only responds to actual contact or touch, rejecting proximity events. This way you can see how your sensors are behaving, which is useful for developing and prototyping.

Search: distance

What is capacitive sensing?

The 12 sensors of the Touch Board use capacitive sensing. But what exactly is capacitive sensing? And what other technology uses capacitive sensing? But what exactly is capacitive sensing? This tutorial gives you a brief oversight about this technology uses capacitive sensing? This way you can see how your sensors are behaving, which is useful for developing and prototyping.

Search: capacitive

Making distance sensors: trigger the Touch Board with proximity

The Touch Board works great out of the box to detect touch. But it’s also possible to trigger sounds from a distance. We call this proximity mode. This tutorial will take you through an example and explain these principles.

Search: distance sensors

Getting started with the Touch Board

This tutorial is a step-by-step introduction to your Touch Board. It will take you through powering it up and changing the sounds on your micro SD card, all the way to using our stencil and Electric Paint to create a series of graphical touch sensors on paper!

Search: getting started

Printed Sensors

Flexible sensors can be made using techniques such as screen printing, flexography, gravure, offset lithography, and inkjet. They are manufactured on a range of substrates, from plastics, to paper and textiles. The Printed Sensors in this pack are inexpensive because they are printed on paper, using our Electric Paint.

Search: grapher

Touch Board + Grapher

We’ve developed the Grapher as a tool to visualize 12 of the Touch Board’s sensors. This way you can see how your sensors are behaving, which is useful for developing and prototyping.

Search: graphe

Your Printed Sensors and Instrument Sensors have up to 16 unsealed access nodes. These allow you to connect the sensors to the Touch Board. There’s many different ways to connect to your Printed Sensors. Electric Paint can be used as a cold solder, or carbon dots can be used to connect between hardware and sensor, although this is a more expensive option. For temporary and quick prototyping, alligator clips can be used to connect from the sensors’ nodes to the electrodes. Connections must be made via the exposed nodes.

SEARCH: grapher

PROPERTIES

- Dimensions: 210mm x 149mm
- Card Stock: 270gsm
- Match Fill: 45% filled with Electric Paint
- Nodes / exposed nodes

APPLICATIONS

Printed Sensors can be used with the Touch Board to quickly extend the sensors from the board. They can be used as touch or proximity sensors. Printed Sensors can be attached to any surface like wood, cardboard or foam to create smart interfaces. Use tape, glue, spray mount or any other standard adhesive to attach them.

CONNECTING

Printed Sensors are sealed, however each sensor has up to 16 unsealed access nodes. These allow you to connect to the sensors to the Touch Board. There’s many different ways to connect to your Printed Sensors. Electric Paint can be used as a cold solder, or carbon dots can be used to connect between hardware and sensor, although this is a more expensive option. For temporary and quick prototyping, alligator clips can be used to connect from the sensors’ nodes to the electrodes. Connections must be made via the exposed nodes.

USAGE

Printed Sensors are screen printed on paper, which makes them flexible, and allows you to cut them down to at least 16 pieces, with an access node each. You can also cut strips of the sensors and use them to connect the front of your surface to the back, by bending the sensor around a corner. The pattern on the Printed Sensors was designed to be used as a touch or proximity sensor.

INNERSENORS

Instrument Sensors are a specific design of our printed sensor technology. This pack contains three different instruments: piano, drums, and sampler. You can use them to either play the respective instrument on the Touch Board or you can change the board’s code and use the sensors as interfaces for your programme.

SENSOR DESIGN

Printed Sensors and Instrument Sensors are examples of the types of designs you can achieve when designing printed and flexible sensors. Depending on the application, you can create your own sensors on a range of materials. When using proximity sensing, the pattern on the sensors can affect performance, so it’s important to follow our sensor design guidelines. You can use a range of conductive inks or experimentation with our Electric Paint to create sensors with various printing methods.

Resources

www.bareconductive.com/tutorials

Check out these online resources for step-by-step instructions, tips and techniques on how to use the Touch Board.
The best design for printed flexible sensors

When you look at the Printed Sensors, the first thing you might notice is the gridded pattern of Electric Paint. More than just a good looking pattern, the Printed Sensors show how precisely you can work with our paint.

How to cover Printed Sensors with a different colour

If you need to quickly create a touch or proximity sensor in a colour other than black, then this is the right tutorial for you! In this tutorial we are going to show you how to cover Printed Sensors with a different colour.

How to use stencils with Printed Sensors

There are many benefits to using stencils in your projects. They’re a great way to create precise forms and lines with Electric Paint, even if you don’t have a steady hand. Additionally, you can cover the electric wiring that makes your project work. It’s a cleaner, more finished way to present your projects and it’s also quite simple.

Electric Paint sensor design rules of thumb

In this tutorial we will give you some guidelines for creating painted sensors. Following these guidelines you should be able to design the best sensors for your specific application.

Resources

www.bareconductive.com/tutorials

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Search: stencils

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Search: sensor design

Check out these online resources for step-by-step instructions, tips and techniques on how to create your own Printed Sensors.

How to integrate Printed Sensors

Using Printed Sensors is a great way to save time, as they can be cut into any shape you like, are already sealed for you and don’t require drying time. Your interface can be a variety of things, such as paper, wood or plastic – whatever works for your project.

Search: integrate

MIDI Paper Orchestra

Make a paper piano, drum, or sampler using the Touch Board and Instrument Sensors. When you’re done, get your teams to band together and play their favourite tune, or create custom instruments.

Touch Board, Electric Paint 10ml tube, Instrument Sensors, carbon dots, mini speaker, micro USB cable...
Also useful but not included: masking tape, wall-mounted USB plug

TAKE IT FURTHER

1. Explore the MIDI sound library and select different sounds for your sensors.
2. Design your own Instrument Sensors using Electric Paint
3. Use the Instrument Sensors as interfaces for a game

MIDI Paper Orchestra

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Check out these online resources for step-by-step instructions, tips and techniques on how to create your own Printed Sensors.
Step 1 Set up your digital tools
If you haven’t set up the Touch Board with Arduino before, please do following this online tutorial: http://bit.ly/TBWPArduino

Step 2 solder the MIDI solder bridges
To use the Touch Board’s onboard MIDI functionality, you need to connect two solder bridges on the board. You can cold solder the bridges using Electric Paint. If you want to go back to MP3 playback mode and play MP3 sound at a later stage, simply remove the solder bridges.

Give the paint a few minutes to dry.

Step 3 Connect to your Instrument Sensor
Your Instrument Sensors have been screen-printed with Electric Paint, so attaching them to the Touch Board will turn them into an interface.

To attach the Touch Board to the Instrument Sensor you can either use carbon dots or cold solder with Electric Paint. Carbon dots aren’t as robust as Electric Paint but they don’t require any drying time. Electric Paint takes a few minutes to dry, but is more stable.

If you haven’t set up the Touch Board with Arduino before, please do following this online tutorial: http://bit.ly/TBWPArduino

Step 4 Upload the MIDI code
With the board attached to the nodules, it’s time to upload the MIDI code to the Touch Board. Connect your Touch Board to your computer with the USB cable and turn the device on.

File → Sketchbook → Touch Board Examples → Midi → Piano
Make sure to select the correct Board and Port settings before hitting upload.

Step 5 Plug and Play
When you have uploaded the code, take the speaker, turn it on and connect it to the Touch Board. Try playing the notes on the piano, you should hear a sound when you touch a key.

Step 6 Swap instruments
The MIDI code is set to “electric piano” by default. If you want to try out a “grand piano”, a different instrument or sound, you can find detailed instructions on how to change the instruments inside the Midi Paint code.

Use the other Instrument Sensors to play different instruments or form an orchestral sound at a later stage, simply remove the solder bridges.

We’d love to see a video of your paper orchestra! Share your images or videos via Instagram or Twitter @Bareconductive.

Step 2 cut the buttons
To begin, you’ll need 3 yellow, 3 green and 2 red sheets of paper or cardboard. Cut these into shapes about 30cm in size. Cut out a small triangle for your start/reset button. Mount these onto foam board to make sure your buttons are robust.

Memory Game
Use Electric Paint to design and control an interface. Connect the Touch Board as an HID keyboard.

When you’re done building this project you can get competitive with this interactive memory game.

Touch Board, Electric Paint 50ml jar, Mono USB cable, alligator clip test leads

Step 3 Prepare the game in Processing
If you haven’t used Processing before, open and close it once so that it generates the necessary environment.

Step 4 Upload the code
While the paint dries, connect your Touch Board to a computer and turn it on. In the Arduino IDE, go to

File → Sketchbook → Touch Board Examples → HID → Keyboard

Step 5 Prepare the code
Go to line 50, comment it out, and comment line 52 in. Make sure to select the correct Board and Port settings before hitting upload.

When the code has been uploaded, swipe across the electrodes on the Touch Board, from E0 to E8, to test the code. The numbers "801234567" should appear. You can remove the line, we’re just checking the code is expected as expected.

TAKE IT FURTHER
1 // Set a new brief, get each team to open up Processing and modify the code to change the visual interface, you can change them to game completely.
2 // Set each group to create a new game from scratch. They can design an interface using Electric Paint and modify the Touch Board’s inputs/outputs using the Arduino IDE.
3 // Change each button to create a new game.

Step 1 Set up your digital tools
Before something begins, make sure to download Processing as instructed in our Guides. If you haven’t set up the Touch Board with Arduino before, please do by following this online tutorial:


Step 5 Prepare the game in Processing
If you haven’t used Processing before, open and close it once so that it generates the necessary environment.

Download the file here: http://bit.ly/TBWPMemoryGame
Unzip the file and move the folder “MemoryGame” to the right location.

Mac
Documents/Processing
Step 6 Connect to the Touch Board
Once the paint has dried and the code has been uploaded to the Touch Board, turn the Touch Board off and disconnect it from the computer. Select 8 alligator clips and attach them to electrodes E0 to E8. Connect the other end to the painted buttons making sure that paint is in contact with the clips. Make sure that none of the cables is crossing over each other, as this might cause interference. In the end, you want to have a set-up similar to the image on the bottom.

Step 7 Play!
Re-connect the Touch Board to the computer and turn it on. In Processing, run the game and then press your start button to play.
Memorise the sequence of colours and press the corresponding buttons. Work your brain and enjoy the memory game!

Interactive Poster
Make an interactive poster using the Touch Board and Printed Sensors.
Upload sounds or record your own audio tracks to tell a story. Make your presentations more engaging with interactive visuals that play sounds!

Step 1 Set up your digital tools
If you haven’t set up the Touch Board with Arduino before, please do so by following this online tutorial: http://bit.ly/TBWPArduino

Step 2 Plan your poster
Before you start making the interactive poster, you need to plan it out. Think about what your interactive points will look like, where they will be positioned, and what material your poster will be. In this example, we are using 4 printouts of animals as our interactive points.

Step 3 Prepare the Touch Board
If you have set up the Touch Board for MIDI before, make sure to remove all Electric Paint from the MIDI bridges. You can ship it off with your fingernail.

Touch Board, microSD Card Reader, microSD Card, mini speaker, Micro USB cable, alligator clip test leads, sticky tabs, velcro stickers
Not included: making tape, foamboard
TAKE IT FURTHER
1 // Use Electric Paint to draw your own graphics as interaction points.
2 // Use different code. Follow our online tutorials to use MIDI, HD or other libraries to produce different outputs for your interactive poster.

Step 4 Audio / MP3 files
We’ve selected some animal facts recorded in MP3 format for our sounds. You can use sounds, a song, or record your own tracks, use a Text to MP3 converter. The choice is yours!
Once your MP3 files are ready, turn the Touch Board off, remove the SD card, and insert the card with the card reader into your computer. On your computer, find the MP3 files that you want to use. The names of the tracks must be TRACKXXX.mp3, where the XX is the corresponding electrode. For example, TRACK000.mp3 is played when electrode E0 is triggered, TRACK003.mp3 for electrode E3 and so on, up to TRACK111.mp3. We’ll be using electrode 0, 3, 6 and 11.

Once you have uploaded all the tracks to the card, remove the SD card from your computer and insert back into your Touch Board.
If you want to have a detailed tutorial on how to upload your own MP3 tracks, check out the detailed tutorial online: http://bit.ly/TBWPChangeMP3

Step 5 Cut the Printed Sensor
Cut the Printed Sensors into the number of sensors you require. Make sure that each piece has at least one access node on it. Nodes are the exposed circles that are on the perimeter of the sensors.

Step 7 Play!
Re-connect the Touch Board to the computer and turn it on. In the Arduino IDE, go to File→Sketchbook→Examples→Proximity_MP3
Make sure to select the correct Board and Port settings before hitting upload.

More with Print and Touch
Create and upload your own sounds and animations, or get creative with other tutorials. You can find more tutorials at: http://bit.ly/TBWPChangeMP3
Step 6 Attach the Printed Sensors
Attach each Printed Sensor behind its designated interaction point (your image). It helps to define these first so you can align the Printed Sensors directly behind. You can use the sticky tabs to attach the Printed Sensors to the poster.

Step 7 Connect the Printed Sensors
Connect each Printed Sensor piece to the Touch Board using alligator clips. It’s easiest if you space the clips out on the Touch Board, for example, connecting E0, E3, E6 and E11.

Step 8 Test the sensors
Turn on your speaker and connect it to the Touch Board. You can also connect it using a velcro sticker. Connect the Touch Board to power and turn it on. Test one sensor at a time by approaching it with your hand. You should hear your tracks!

Step 9 Test your interactive poster
With everything in place, you can now add the final touches to your interactive poster. With the Touch Board and the speakers turned on, touch your interactive points on the front. You should hear your tracks again!

In order to reduce troubleshooting, it’s useful to coil up any slack wires and secure them with masking tape. Cables that hang around loosely tend to cause interference with each other.

Resources

How to use proximity sensors
Capacitive sensors allow you to either have touch sensors, proximity sensors or even a combination of both. With the proximity sensors, you can choose between having an “on or off switch” or using the proximity sensing to gradually fade an LED on or off.

How to clean the electrodes
If you have just started using the Touch Board, you might not be familiar with how to debug or troubleshoot any issues you might be having. Perhaps the electrodes of your board are not responding to touch. In this tutorial, we show you how to debug the Touch Board.

The Touch Board as an HID keyboard
Have you ever wanted to use your Touch Board as an HID keyboard input to your computer? You might want it to control your favourite online arcade game, or maybe you have another use in mind that requires keypad input. Either way, follow this tutorial and soon you will be typing away via the power of capacitive touch.

How to create talking plants
In this tutorial, we’re going to show you how to create talking plants. When you approach the plant with your hand, you can hear a voice message. This can be instructions on how to take care of it. For example, we have created little instructions that tell the listener how much water the plant needs.

How to fade an LED on with proximity and the Touch Board
In this tutorial, we show you how to fade an LED on with proximity and the Touch Board, creating a dimmer effect.
Products

**Electric Paint 10ml**
Running low on Electric Paint? Don’t let your projects wait. Order more tubes today.

**Electric Paint 50ml**
Haven’t tried screen printing with Electric Paint yet? Get your hands on this jar, asap.

**Electric Paint 1L**
Scale up your projects. The 1L tub has enough material to bring your biggest ideas to life.

**Printed Sensors (set of 3)**
No time to paint? No problem. Stock up on Printed Sensors and get prototyping in no time.

**Light Up Board**
Integrate light into your next project with the Light Up Board. Pre-programmed with six different light modes.

**Pi Cap**
Give your Raspberry Pi the power of 12 touch sensors. Add audio, polyphonic playback, GPIO connectors and more!

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