

Wind Instrument Building

day 1

Marije Baalman

May 10, 11, 12

Overview

- Day 1: focus on making sensors
- Day 2: focus on receiving and processing data
- Day 3: focus on connecting the data to sound and visuals

On the first day of the workshop we will fly some kites and use *conductive foil and thread* to create sensors that are affected by flying the kite.

- For example, we can make a pressure sensor, that measures the pressure of the wind on the kite.
- Or we can create a tail for the kite that can measure the turbulation of its own movement.

We will create these sensors, measure their resistance with multimeters, and solder wires and resistors to connect them to a sensor board.

At the end of this day, participants will have created or modified a kite to have embedded sensors, than can be connected to the *Sense/Stage MiniBee*, a wireless sensor board with a microcontroller.

Day 2 - receiving and processing data

On the second day of the workshop, we will focus on using the Sense/Stage MiniBee platform to receive the data from the sensor, while the kite is in the air.

We will learn how to view and understand the data in *Processing*, and learn some simple methods to process the data.

The **Sense/Stage MiniBee platform** is a wireless sensing platform created for artists, based on the *Arduino* platform. The sensing board includes an accelerometer, and can be used to attach various sensors to it. The preprogrammed firmware, along with the software allows for easy configuration of the hardware, so you can immediately start receiving data. For an introduction see:

<https://docs.sensestage.eu/sensestage-v1/overview-of-the-system>

At the end of this day, participants will have a basic setup to receive and analyse data from the sensors in realtime, and have learnt some basic methods for processing the data.

On the third day of the workshop, we will focus on using the data to create sound (or visuals).

I will share some of her methods of using the realtime data that she uses in her current exhibition in Tainan (Sails, Sugar, Silicon), implemented in SuperCollider and in her performance Wind Instrument (with a two line kite).

After that participants can work with their kite and create their own mappings to sound or visuals, in the programming environment they prefer and have experience with (as long as the environment can receive OpenSoundControl (OSC) messages), such as Processing, Max/MSP, PureData, SuperCollider, Ableton + Max4Live, ...

At the end of the day, we will showcase our results by flying the kites, and listening to how they sound!

Introductions

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- Active since 2001 making electronic music performances and since then have also created several installations.
- Working in different collaborations with other artists.
- From sound now also using other media such as light.
- Moving towards more conceptual work.

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Mixed, interdisciplinary background in physics, acoustics, electronic music, sound art

- <https://marijebaalman.eu>

Composing Interactions

An Artist's Guide to Building Expressive Interactive Systems



Round of introductions

- who are you?
- what is your background?
- what do you hope to learn during the workshop?
- which experience do you bring to the workshop?

Wind Instruments

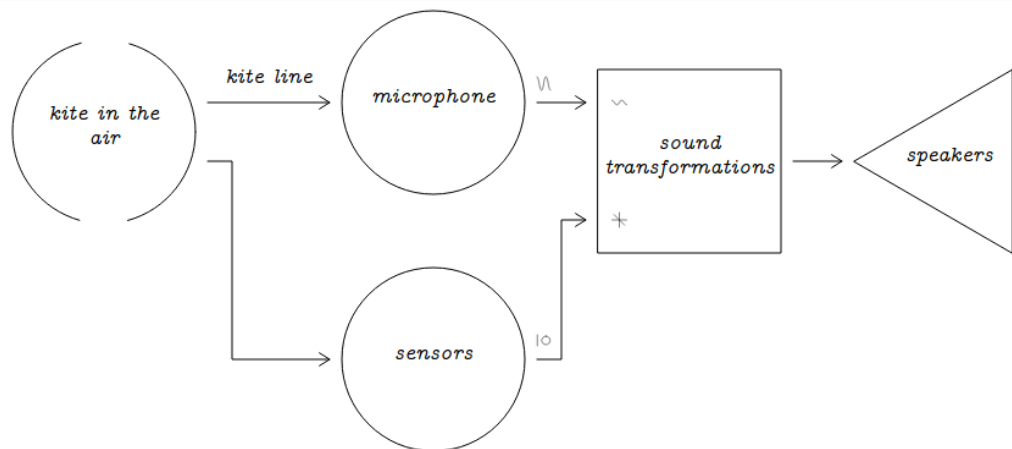


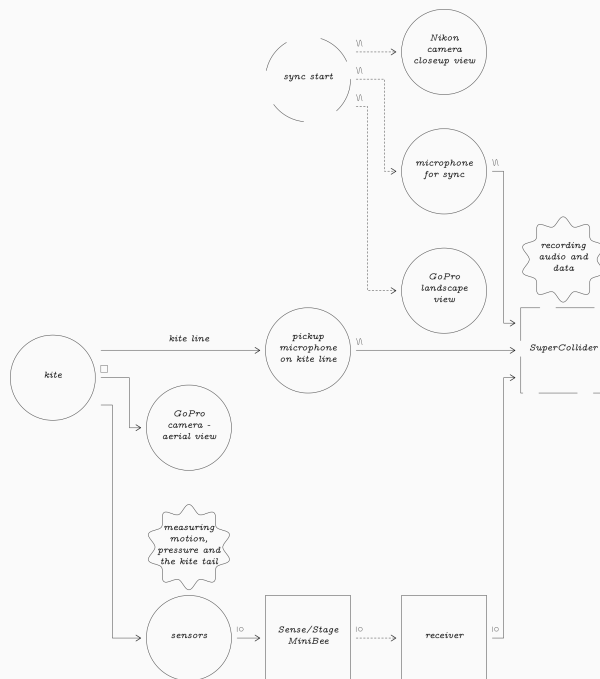
V.L.I.G. (vliegen, liggen in gedachten)

(flying, lying in thought)

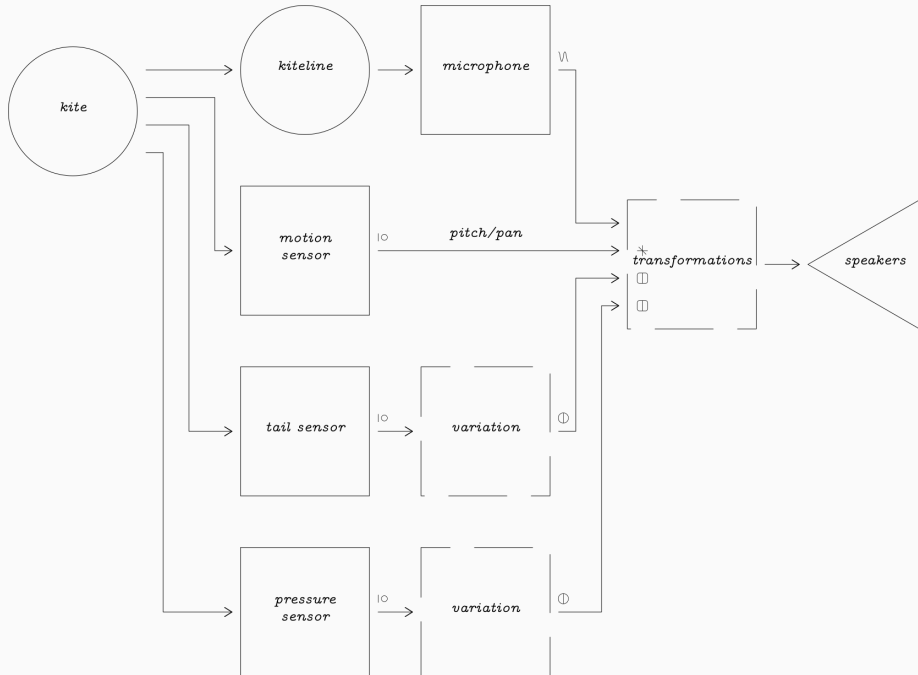
Current exhibition at Siou-Long Cultural Park in Tainan (Jiali)







V.L.I.G. - detailed concept



Day 1 - making sensors

- Introduction
 - What is a sensor?
 - How to create a sensor?
- Kiting
 - Look at how the kite moves and is affected by the wind
- Creating sensors
- Soldering connections to the sensors

Sensors

What is a sensor?

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Most often a sensor is used to measure a physical quantity, and transform it into an electronic signal.

Self-made sensors: conductive materials and resistance

Using conductive materials, you can create your own sensors.

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For example:

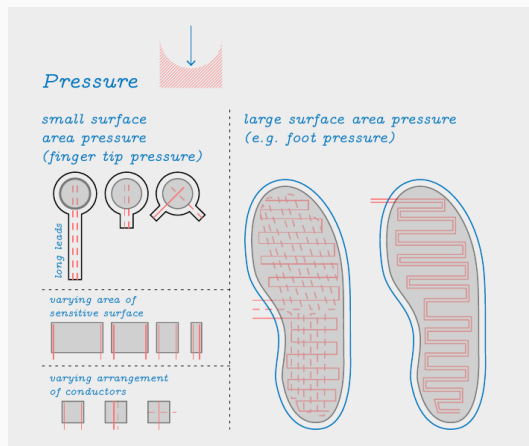
- a pressure sensor - by layering conductive materials: as they are pressed together the layers make more contact and the electronic resistance between them changes.

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Kiting

- How does the kite move?

Observe the kite

- How does the kite move?
- On which parts of the kite does the wind exert pressure?

- How does the kite move?
- On which parts of the kite does the wind exert pressure?
- Add a simple tail to the kite (from garbage bag plastic)
 - And see how it moves in the air

Making sensors

- *Introduction*
 - sensor making techniques
 - measuring resistance
 - soldering connections

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- *Look at the data on my computer*

Making a pressure sensor

- conductive thread
- conductive foil

For the connections:

- insulated copper wires
- copper tape
- header pins

- zigzag an embroidered pattern with thread on kite surface (fabric/plastic)
- add a layer of conductive foil, that is loosely at the back of the kite surface

Drawing zigzag pattern



Embroidered zigzag pattern



Embroidered zigzag pattern



- Pre-tin the wires, by letting some solder into it
- Pre-tin the copper tape, by letting some solder into it
- Pre-tin the header, by putting some solder onto each pin

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- Tape the copper tape onto the foil
- Tape the copper tape onto the thread

Alternately, you can also solder directly onto the conductive thread

*Warning: if you put the copper tape onto the foil **before soldering**, the foil will melt when you try to solder*



Making a kite tail sensor

Kite tail



- conductive foil

For the connections:

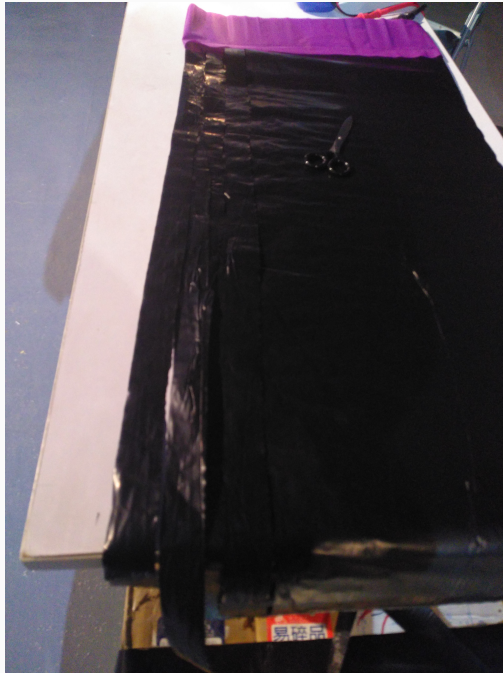
- insulated copper wires
- copper tape
- header pins

- determine the length of the tail
- cut two large pieces of conductive foil, that have the length of the tail and a good width
- determine the length of the tail stripes
- put some insulating material at the top between the two layers, and on the outside of the layers
- make long cuts in the material to create the stripes, but make sure that the layer at the top stays connected
- fold the tail up
- sew or tape the tail so that it stays in the desired shape
- attach a piece of wire so that you can connect it to the kite.

Layers



Stripes



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- Tape the copper tape onto the foil

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Circuit to measure the resistance

Measuring resistance



Voltage divider

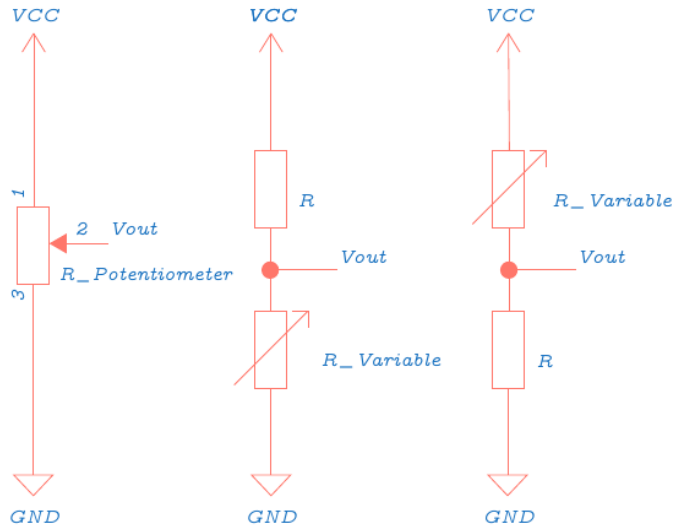


Figure 5.17 — Electronic circuits for the voltage divider. The left image is a potentiometer or slider, on the middle and right are

voltage dividers for a variable resistor in series with a fixed, static resistor.

Calculating the best resistance for the second resistor

The voltage that can be measured can be calculated with the formula:

$$V_{out} = \frac{R}{R + R_{variable}} V_{cc}$$

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The best resistor to use with your resistive sensor can be calculated with the following steps:

- Measure the value of the resistance of the sensor when fully pressed:

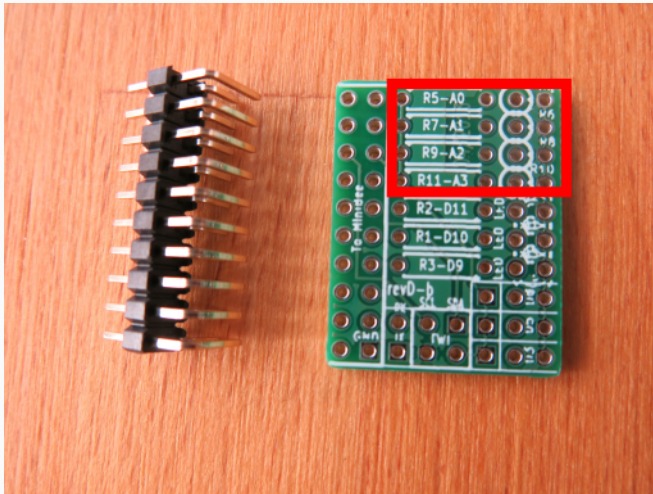
$$R_{pressed}$$

- Measure the value of the resistance of the sensor without pressure on it:

$$R_{free}$$

- Multiply the two values measured: $R_{pressed} * R_{free}$
- Take the square root of this: $\sqrt{R_{pressed} * R_{free}}$
- Take a fixed resistor that has a resistance value close to this calculated value.

Soldering the resistor and header onto the PCB



Next steps

Schedule for the afternoon

- Experiment with the conductive material
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- iii - instrument inventors initiative
- National Taiwan Science Education Center

- Some images are taken from the book *Composing Interactions*
- the research for the book *Composing Interactions* was funded by Creative Industries Fund NL