**Prototype Report 1 - Artifact : Reactive Garment** November 13th, 2020

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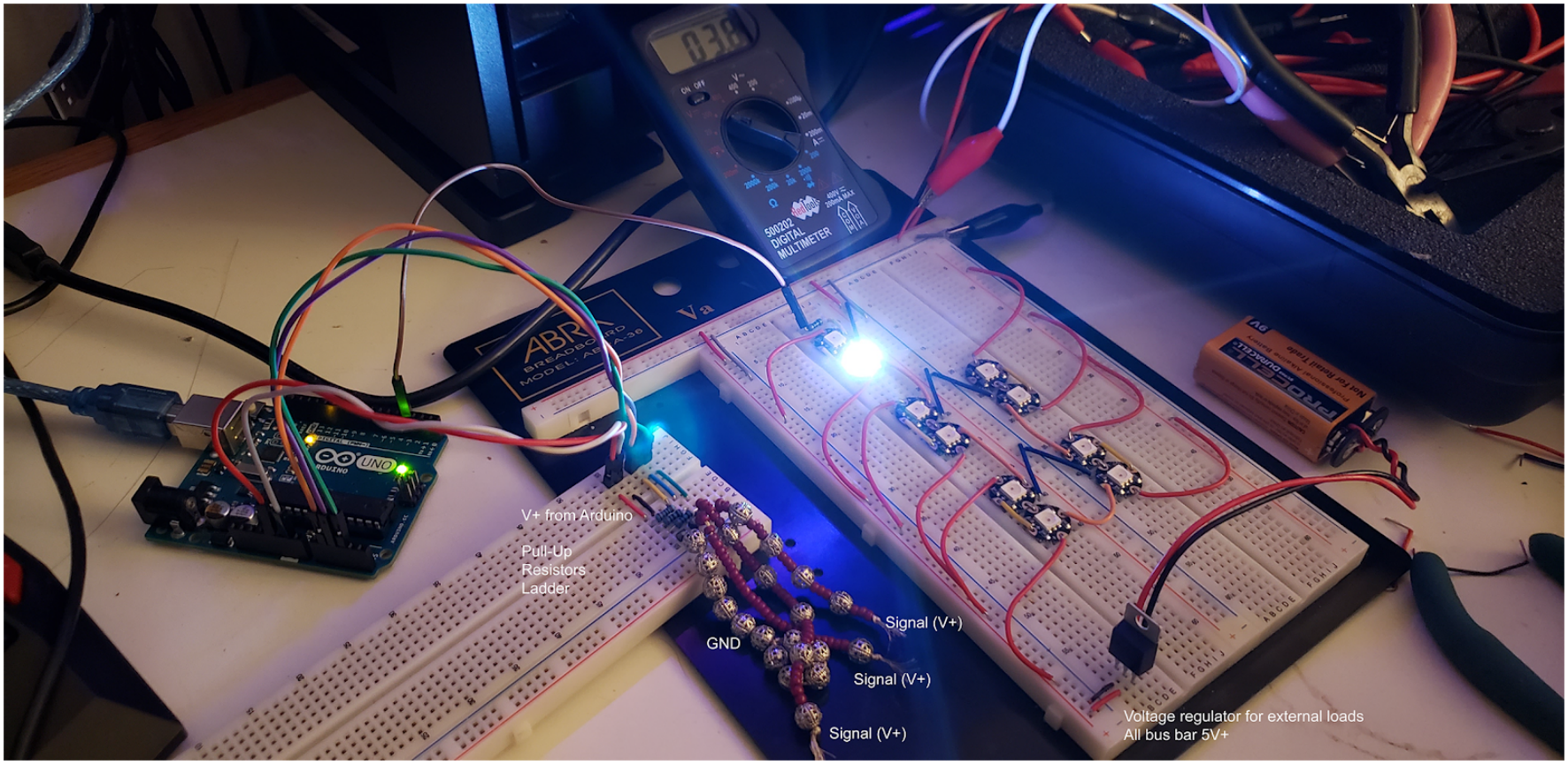
## I. Why Do We Prototype?

### I.I. To Understand

After years of crafting with curiosity and reverse engineering, one may find itself gifted with more materials than what they actually need. Given the wide range of possible arduino spin-off, the first step was definitely to regroup and identify design challenges and possibilities. This prototype report should address each step evolution of the proposal (low-fi to mid-fi), but also the intentions that stayed after an exploration in reactive garment.

The most achievable aspect of my initial artifact proposal is to create a piece of electronics disguised as a wearable/jewelry sensor. To do so, I used conductive thread and silver beads combined with different resistors to create an analogue voltage input for the circuit. Even though the signal still needs tuning at the moment, the code in SwaySensorMeasurements.ino shows its functionality. Next step in integration would be to map its reading with a better process in code and react on the lights accordingly.

Narrowing down on the right components is also one of the main purposes of this process. Given the accessibility and commercialisation of electronics, it's easy nowadays to modify an existing circuit and directly sew it on with simple rewiring. It required research and testing to realise that some e-textile tuning and exploration can easily be replaced by a capacitive touchpad for prototyping, and some sensors should just be discarded at the moment, for they no longer fit the story. (see sensor table of affordability) It helped with choosing the right component to complete what I already own.




**I.II. To Test and Improve**

The pre-testing phase allowed me to apply some electronics principles visited in class such as the voltage division with analog sensing and to better understand what I was working with. Projections and prototyping at different fidelity levels helped design a coherent artifact in its form and function and broke down the project into smaller realisation steps; sometimes going backward to simplify. This approach also allows for in-depth developpement of every aspect. ( see table : Fidelity Levels ) If I may compare with sewing again, time needed on a piece of clothing after testing on a sample can be at least twice less, and the quality will rise.

**I.III. Why** (see annexe I - Mind Map)

Positioning your story and product can take a lot of different paths. Building a prototype, or samples in tailoring, is a way to tackle design challenges one at a time and prevents quality issues before mass manufacturing. They also offer a tangible form at different development levels of our original ideas. These iterations can be fitted on a client or presented to an investment group (our class ;) ) to achieve the original conceptual objectives and commit to a final form. Focus groups are an essential part of communication and integration; where what resonates with the artist's intention might be perceived differently from the audience.

For my friends in the living arts, what they need is something that lights up for a night event, that is solid enough to perform in confidence, but also safe enough on the body for acrobatics. Then a friend of mine found a luminous fabric in the dumpster after a corporate event, it was thrown away because it's very lightly broken on one edge. This gift started the way to work with a new material, electronics and light, and developing a stage costume that also makes my techniques evolve is part of why this outfit holds a personal meaning.

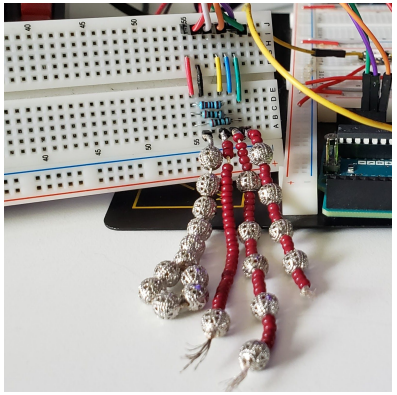
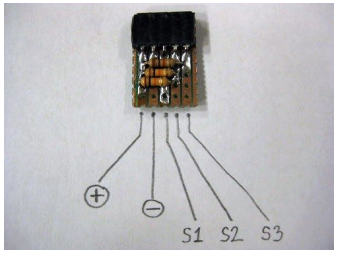
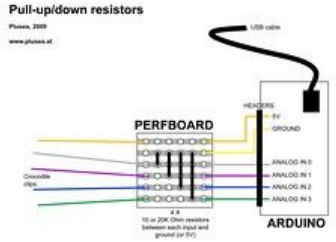
**I.IV. To Advocate Intentions**

As the market evolves, I want to integrate more of the soft electronics and capacitive sensing in my practice because it offers a calm way to interact with wearables. The connectivity of the sway sensor can evolve in numbers and in embroidery traces along the optic fibers to provide many layers of light effects and materiality. The concept explored when prototyping offers a wide libraires of possibilities for a collection or art series, as well as narrowing down the story of an individual artifact.

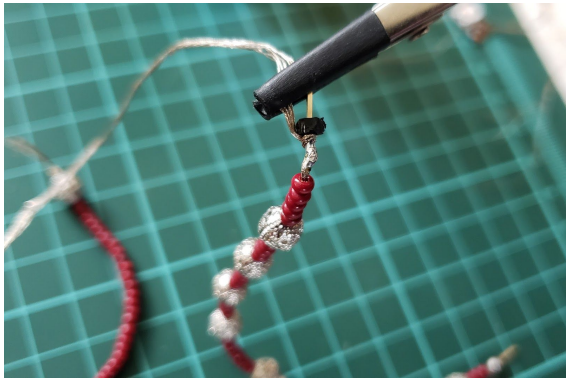
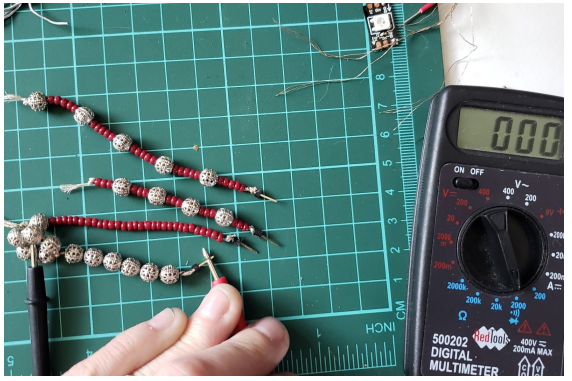
## II. Fidelity Levels to the development process of your Physical Prototype

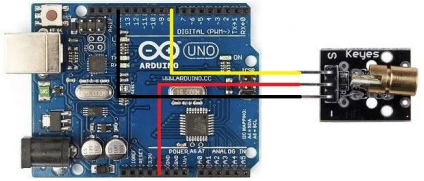
| **Lvl** | | **to-do for Nov. 20th** | | **to-do Dec. 4th** |
|---|---|---|---|---|
| **Mid** | Components/Materiality | evaluate each sensor separately | revisit interaction storyboard | |
| **Low** | Software | add new sensors to flow chart add codes | iterate | merge codes |
| **Low-Mid** | Integration | connections for new sensors,<br>LabView charts<br>Have more Neopixel work | complete circuit diagram | integrate soldering and final wires |
| **Low** | Form/Structure | **sketch** final garment<br>(know final length and form) | sewn prototype + dimensions | finalization |
| **Mid** | Documentation | **prototype video assets** | | |

## III. Technical Evaluation

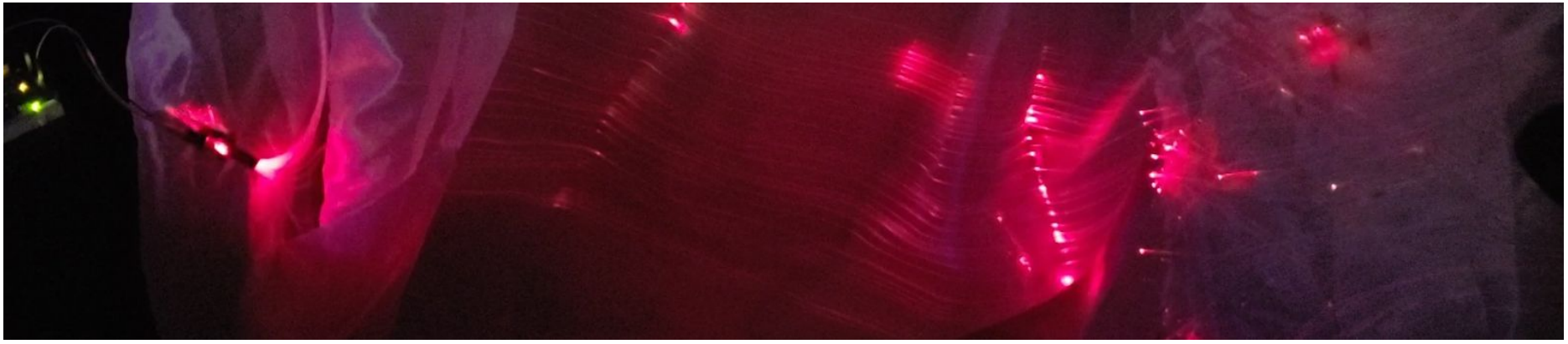
| From proposal | Technicalities/Integration | Interaction Design pro/cons | Reference - Annexe II |
|---|---|---|---|
| Conductive thread and materials for DIY signals  |     | • analogRead() + Peak detection over time<br>• contact switch<br>• Graph charts | Beaded Sway Sensor<br>Broach<br>SwaySensorMeasurements.ino |

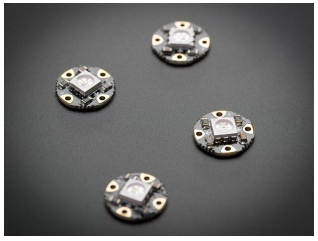
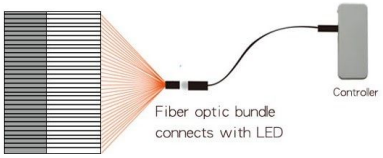
From the conductive materials explored in the proposal, I kept the conductive thread for its versatility and combined it with silver beads and different resistors to build a sway sensor. I find it subtle yet effective and provides with some variety in modes and measures. Can copy and recreate at different intervals on textile.

| From proposal | Technicalities/Integration | Interaction Design pro/cons | Reference - Annexe II |
|---|---|---|---|
| KY-008 Laser Transmitter |  | • LOW/HIGH only<br>• Use for signal? (photocell reaction)<br>• Alternative to LED (beautiful with mirrors) | instructions<br>LASER_BLINK.ino |

Using the KY-008 Laser Transmitter for light transmission was an effective experiment with the optic-fiber textile as a diffuser but provided with less light effect option then the sewables LED and the neopixel librairie. Both the laser and the LEDs are good components if also used as a signal.



| LED effect & diffuser | Technicalities/Integration | Interaction Design pro/cons | Reference - Annexe II |
|---|---|---|---|
| 10x Flora sewable LED  | have their own communication protocol that isn't I2C or SPI   | • Addressable RGB and wide librairie<br>• Use for signal (photocell reaction) | Twinkle.ino<br>Neopixel Librairie<br><br>IC drivers?<br>https://www.adafruit.com/product/1378<br>Multiplexer? |

I want to 'recycle' 5 meters of optic fibers textile that can be tailored and cut, but we must design around its specifications. The linearity of the fibers should be a visual part of the tailoring aspect.

Luminescent fabric with layers of cut textile over it?

Affords the acrobat a costume that fulfill its need to be seen if they perform at night.

...

sketch

*rachael-reichert-fiber-optic-fabric-corset-dress*

## IV. Has your Project's initial intention or supposed meaning changed over the course of researching and implementing the Physical Prototype?

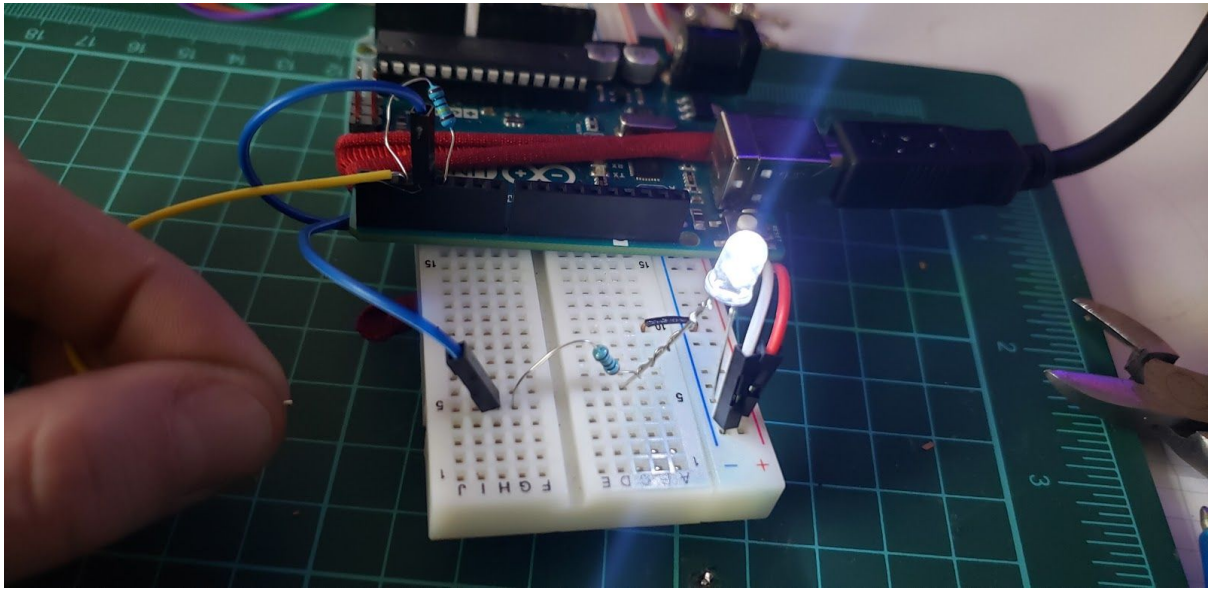
My artifact has changed in ways that it coercise in its form. Which sensor to use and why it mattered today was made clear once the evaluation of the components was over. Tuning and calibrations are still to be expected until the final product delivery though. The original idea of using soft electronics and e-textile isn't discarded just yet but connecting a prefabricated touchpad might be the way to go as a learning alternative on capacitive sensing. The extensive research and readings expanded my knowledge of possible interactivity with garment on a level I did not expect, particularly on communication protocols and accessibility in art practice. I realized that even though e-textile can be a means of their own, building a complete system from scratch requires knowledge that one could learn more easily with prefabricated modules, and then translate it into wearables.

To measure accurately sensorial sensing, I plugged in a myDAQ device and LabView software to graph the reactions of movement (V/I) over time. I'm having issues with the data collecting device connecting at the moment but I plan on reporting precise charts of my analog sensor exploration. The final meaningful interaction that stayed, would be the reactions on the textile; a reaction that activates without the user having to go out of his way to activate it. The Neopixel LED-modules work well at the moment, they come with a wide librairie of effects and this layer of versatility is yet to explore further. I'm thinking of using a magnetic switch as a proximity trigger to override the first sensorial effect on LEDS.

I'll keep other sensing devices like the MPU-6050 Gyro accelerometer for later props of the same collection; to keep merging the materials I've gathered with the simple missing components it needed to function.

**Evaluation of changes from capacitive e-textile sensing**

| From research-creation | Technicalities/Integration | Interaction Design pro/cons | Reference |
|---|---|---|---|
| Capacitive touch disk pad<br>  | • Measures the capacitance of 15 electrode points<br>• Can connect to any Capacitive module<br>• Or DIY because modules are rough on the skin | • Code integration exploration<br>• Allows for further e-textile integrations, layer over layers<br>• Sensitivity calibration | CapacitiveSensorSketch.ino<br><br>CapSense<br>Arduino tutorial<br>Instructables<br><br>Digital pins as capacitive sensors<br><br>Bare conductive |



| | | | |
|---|---|---|---|
| Hall Effect Sensor Module  | • Deactivation/Activation: 10-30 Gauss<br>• Connection 3 pins 5V, Gnd, S | • Magnetic contact switch<br>• As long as the magnet is closeby? while(){}<br>• “Calm Interaction” = Sway Switch ? | Manual |

*Soft electronics and e-textiles such as a zipper for potentiometer, stroke sensor with conductive thread are kept for later iterations and integration. EEG electrodes were discarded because of the cost and the need to wire to a computer.*

## V. Documentation

- Prepare a Video Presentation (10 - 15 min) of your Project and Prototype and upload to Moodle (CART360: Prototype Presentations).

video presentation - see ASSETS folder
Part 1 - components & affordances
Part 2 - story and interaction

- & Provide feedback on four submitted Prototypes via the PROTOTYPE FEEDBACK forum.

**Annexe I - Conceptual MindMap**
**Annexe II - Arduino Codes**
**Annexe III - Tables; graph, cost and time**

> Every reader finds himself. The writer's work is merely a kind of optical instrument that makes it possible for the reader to discern what, without this book, he would perhaps never have seen in himself.”